Engine Foundations in Asphaltic Masonry.

M. Leon Malo, in *Le Genie Civil*, of November, 6, makes some general remarks upon the subject of asphaltic foundations as used for the purpose of absorbing the shock and vibration incident to heavy machinery.

He has been experimenting in this direction for about three years and mentions that his first paper on this subject, read before the Society of Engineers of France, Oct. 6, 1883 (See ENGINEERING NEWS Nov. 24, 1883) was received with a certain curiosity "mingled with sympathetically disguised incredulity." To that time even the technical public only knew asphalt as a material that was liable to stick to the soles of boots and wheels of carriage when the sun was a little too hot; its employment under conditions requiring the use of the most tenacious and indeformable of the materials of construction was a novelty.

But its successful application to the foundations of a 100 horse-power engine (See Fig.)—has proved its good qualities, This engine makes seventy-five revolutions per minute and rests upon a block of asphalt masonry 11.48 feet high, 13.12 feet long and 4.10 feet wide. The crucial test of the qualities of this new material lie in the fact that the heavy flywheel rests upon two such masses independent of each other and differing in volume as seen. If the least deformation under load or work was possible in either, the fact would at once be made apparent in the bearings. This engine had been steadily at work for four months, when M. Malo wrote, and has performed its duty with remarkable regularity.

M. Malo, in speaking of asphalt, says it is a mineral found necessarily in calcareous formations. The most important quarries in France are those of Seyssel; in Switzerland, the Val-de-Travers and in Italy, the Ragusa (Sicily). It is an amorphous carbonate of lime perfectly pure, but impregnated with bitumen by geological phenomena still imperfectly accounted for.

The uses of asphalt are of two kinds: In a natural state, without any other preparation than by being pulverized cold and then moderately heated, it is employed in the construction of roads and is then known as *asphalte comprimé*. While this process has no connection with the subject in hand, M. Malo very successfully used a bed of this *asphalte comprimé* under the anvils of two heavy steam hammers in a workshop in the Basin of the Loiré; previously to its use the shock of these hammers shook the building, but a 10-inch bed of this powdered asphalt compressed into an iron box and placed under the hammers was sufficient to render the vibration harmless.

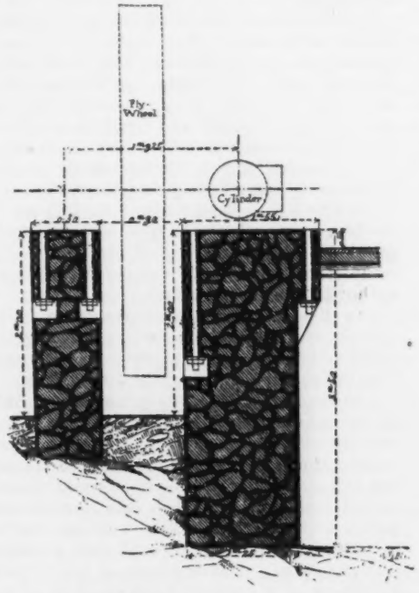
In the foundations referred to in M. Malo's paper asphalt in the state of a fusible mastic was employed. This mastic was made as follows:

After the mineral had been reduced to a powder cold, it was thrown in small doses into a bath of bitumen constantly agitated, until the mixture represented a proportion of seven or eight parts of bitumen to ninety-two or ninety-three of asphalt. At the end of about six hours of a boiling, reaching 437° F. of temperature, the paste was poured out into moulds and cooled; this formed the *mastic d'asphalte* of commerce. This mastic, re-melted with the addition of its weight in gravel and 4 or 5 per cent. of bitumen, furnishes the material used in the sidewalks of Paris.

It is this same mastic that is employed in the formation of the asphaltic masonry referred to. To make it, a mould of any required volume is used, and in this are arranged blocks of stone with irregular joints, and into the interstices asphalt mastic is poured in place of cement; when cool we obtain a block of absolute solidity and tenacity. It will withstand any climatic temperature without the slightest deformation and will require powerful explosives to destroy it. But, at the same time, this block has a very slight elasticity which permits it to absorb vibrations in such a manner that any motion transmitted to one face will be imperceptible on the other.

In the foundation shown, a mould was made of full size with planks and then lined with common thick paper to prevent the asphalt from sticking to the wood. Openings were left for anchor-bolts, etc., by setting up slightly conical billets of wood and supporting them in place by light framework; these, too, were covered with paper.

The mould being completed, operations were commenced by pouring over the bottom a bed of liquid asphalt very hot (about 392° F.);



Asphaltic Foundations for 100 H. P. Engine.

into this stones of a large size, previously warmed, were arranged so as to leave as little empty space as possible, small stones being introduced into all the joints. The first bed being thus finished, and it need not be level, a second is proceeded with in like manner; that is by pouring on it a new bed of liquid asphalt and building up as before; the courses being thus laid until the requisite height is reached.

The construction consumes several days, as each course should be left to cool successively; and in leaving the work in the evening a number of stones imbedded at their under side in the asphalt should be left as keys for the next days work. The mould itself was not removed until the mass had had twelve days to cool. But the erection of the engine was then at once commenced.

M. Malo concludes with some warning remarks to those who propose to use this masonry. The first refers to the direct contact of heated bodies to the asphaltic surface. He says, for example, that the cylinder of a high-pressure engine might be heated to 300° *F*; and were this cylinder to rest directly on the masonry the asphalte would be softened to a depth of some millimeters, and its sinking to that extent would interfere with the working of the machine. To avoid this consequence, the user should interpose a layer of some non-conducting material; cement will answer the purpose. A steam cylinder should be isolated by a ring of brick laid in cement.

The second thing to be guarded against is the contact of lubricants which are a solvent of bitumen, mineral oils above all others. The effect of such oils is to soften the surface exactly as by heat, and with the same results; zinc or sheet-iron pans at all points where oil may drip is the remedy.

M. Malo says he can give no exact cost of the process, as this is determined by the volume and complexity of shape of the block, and its distances from asphalt-producing points. So far this work has been experimental, and the examples are too few to base a definite opinion upon as to cost. The good results accruing have been established beyond a doubt. Its slight inherent elasticity without deformation is the chief and valued characteristic of this class of masonry.

ACCIDENTS IN MINES.*

(*Concluded from page 355.*)

Summary of Report.

In the following paragraphs we give a summary of the most important subjects dealt with in our Report and of the chief conclusions and recommendations based upon them:—†

Volumes of air sufficient for the ventilation of even the most extensive collieries are capable of being passed through the workings by means of properly constructed furnaces, or by mechanical contrivances, such as are already in action at most of the collieries.

At a large number of collieries the sectional area of the intake and return-air-courses may be increased with advantage.

Where furnaces are used, they should by preference be in connection with dry and deep shafts, and should be provided with dumb drifts.

Where mechanical contrivances are employed, they should be in such positions and placed under such conditions as will tend to ensure their being uninjured by an explosion, and, if they are not provided altogether in duplicate, there should be least an engine in reserve.

The improved system of ventilation by "splits" and the shortening of the air courses, as practised in the larger collieries, is a subject of great importance, and we recommend that more general attention should be given to it.

It would conduce greatly to safety if the system of carrying the intake air through two parallel drifts, of which one may be used as the traveling road, were introduced into workings likely to become extensive, and where mechanical haulage is intended to be employed.

That the casualties due to falls of the roof and sides are much more numerous than those due to any other causes is demonstrated by the tabular statement given at the commencement of this report. It is essential that all the officials and workmen in mines should pay special attention to the careful propping of the working places and traveling roads.

In the North of England the system of trusting mainly to officials (deputies) for the timbering, is found to answer well; in South Wales and other districts, where the roof, face and sides are more liable to falls, the system of the men timbering their own working places has been found to be best.

We are of opinion, however, that in all cases

*From "Final Report of Her Majesty's Commissioners appointed to inquire into Accidents in Mines, etc." 1886

†Chapter VIII is a voluminous description of the details of testing a great number of patented lamps, which is more interesting to the patentee than to the general reader. On mature deliberation, we have concluded to omit it here, especially as the summary of conclusions of the Commission really gives all the essential data relating to this lamp chapter.

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the security of the working-places should be examined into by over-lookers once at least in the course of each shift.

Supervision has been greatly enlarged in the last thirty-five years, and we find that there is generally one official so employed to about twenty men, sometimes one even to eleven or twelve men.

In order to reduce the number of casualties from falls, we recommend the observance of the following:—

A. The maintenance of ample supplies of timber in localities convenient to the workmen.

B. The proper training of each miner to the best modes of timbering and of otherwise protecting his working place.

C. The exercise of increased care on the part of the workmen in watching the roof, sides, and face, and protecting themselves in time.

D. The introduction, as far as possible, of arrangements with the workmen, which will make it their interest not to avoid the labor of putting up the necessary timber, cog walls, buildings, or nogs for their proper protection.

E. The employment of special timbermen or deputies for the timbering of mainways and also for the repairing as well as drawing of timber.

F. Preventing timber being left in the goaf of long wall workings, which would have the effect of breaking the roof.

G. Driving the working places as rapidly as possible by shifts of an ample number of workmen in each face, and so reducing the risk of falls and exposing the least number of men to danger at any one time.

We are of opinion that by improved discipline and the exercise of greater care by those employed in or traveling through engine planes and other road-ways, the number of casualties comprised under the head of "miscellaneous accidents," would be considerably diminished. The practice in some collieries in South Wales of boys running in front of the horses and trams should be prohibited.

The very numerous casualities under the heads of "falls of roof and sides" and "miscellaneous accidents," are due in great part either to carelessness or want of early training. Looking to the importance of practical training and of encouraging boys to enter the mines at the ages specified by the Mines Regulation Act, we are of opinion that careful consideration should be given to this point in connection with the administration of the Elementary Education Act.

We think that the experiments we have made on the pressure of fire-damp in plugged bore holes, in coal, a pressure sometimes amounting to upwards of 400 pounds on the square inch, have thrown much light upon the occurrence of sudden outbursts of gas. The boring of holes upward or downward has been sucessfully tried as a means of avoiding such outbursts, and we have little doubt that the closer attention which is now paid to thorough stowing and packing or building in the workings will contribute greatly to the same end.

It is almost impossible to account for many of the accidents which have occurred in well managed mines, some of which have originated in the main-intake airways, except upon the supposition that gas has suddenly invaded the workings from the adjacent strata. Sudden outbursts of large quantities of gas, accompanied by violent disruption of the floor, roof, or coal, are fortunately rare, but smaller incursions of gas, accompanied by falls of roof, or even without any apparent displacement of ground, are comparatively frequent.

We are of opinion that in working fiery seams at great depths such abnormal discharges of gas must occasionally occur, yet that they may be successfully met by ample ventilation, good discipline and efficient lamps.

While we recognize that variations of atmospheric pressure exert an influence on the escape of gases which have accumulated in cavities, and possibly to a slight extent on that of gases emitted directly from the coal, we entertain great doubt as to the wisdom of placing reliance on the issue of meteorological warnings. These can at best only convey very imperfect information, which, moreover, may be sometimes dangerously misleading. We are of opinion that safety would be much more likely to be ensured by unceasing vigilance on the part of the officials and workmen in the mine than by any attention to such warnings.

The action and effects of coal-dust in connection with mine explosions have been made the subject of careful study and comprehensive experiment by numerous workers since attention was first drawn, about forty-two years ago, by Faraday and Lyell to the functions exercised by coal-dust in "aggravating and extending the injurious effects of fire-damp explosions." The results and conclusions which have been arrived at in this direction, and to which the labors of your Commissioners have contributed, are sufficiently complete and definite to warrant the following authoritative statements:—

The disastrous effects of fire-damp explosions in coal-mines are almost always aggravated and extended by the existence of coal-dust in *dry* mine-workings and roadways.

A gas explosion in a *dry* mine, even if only of comparatively trifling nature, will raise and inflame coal-dust existing at the seat of the explosion or in the vicinity; the flame attending the explosion will be thereby increased and carried to more or less considerable distances and may thus become communicated to any accumulations of explosive gas-mixture which may exist in goaves or other lurking places at a distance from the seat of the original gas-explosion.

The firing of an explosive in a shot-hole of a strength which is in excess of the power applied, or which has not been sufficiently tamped, will result in the almost complete projection of the highly heated products of explosion and of a more or less considerable body of flame from the mouth of the hole, as from the bore of a gun; it thus produces what is known as a *blown-out shot*. And further, if the charge of explosive is decidedly greater than that necessary to perform the desired work in the coal or stone where it is applied, a more or less considerable projection of highly heated products of explosion will also take place, and effects similar to those of a blown-out shot will be produced.

The production of a blown-out *powder* shot in a mine working, *in the entire absence of coal-dust*, or in a wet mine, is not attended by the projection of flame to a very considerable distance, but the flame thus projected is much increased in volume if, as is frequently the practice, dry or slightly damp small coal has been used as stemming for the shot.

If a blown-out *powder* shot be produced in a *dry* locality where coal-dust exists in more or less abundance, the flame, projected by the shot, is sure to be considerably increased and extended by the ignition of portions of the dust-cloud which is raised by the rush of air occasioned by the firing of the shot. A result of this nature will be produced even if the air in the vicinity of the blown-out shot is entirely free from fire-damp.

Unless the coal-dust which exists in the immediate vicinity of a blown-out *powder*-shot is dry, very finely-divided and of a very highly inflammable character, the propagation of flame from the shot by the raised dust will only take place to a comparatively limited extent if the atmosphere in which the dust is raised be entirely free from fire-damp.

It is, however, well established that even when the air is quite free from fire-damp, an exceptionally inflammable coal-dust, in a very finely-divided and dry condition, and existing in abundance in the immediate vicinity of a blown-out shot, may, when raised by the shot, be ignited so readily, and carry on the flame so rapidly, that it may produce explosive effects of a similar character to those caused by a gas explosion. The flame as it rushes along, if fed by freshly raised dust, may extend under these circumstances to very considerable distances, with results resembling, in their disastrous nature, those of explosions originating with, and mainly due to, fire-damp.

If a blown-out *powder*-shot occurs in a locality where the atmosphere contains a small proportion of fire-damp (even not above two parts in 100 of the air), the presence of dry, fine and porous dust, even if it be only comparatively slightly inflammable, may give rise to the explosive propagation of flame to distant localities, where either accumulations of inflammable or explosive gas-mixture (as in goaves or old working places), or deposits of very inflammable dust, may take up the explosion and still further extend its disastrous effects.

Wherever a coal is worked which contains inflammable gas, the atmosphere in the vicinity of the workings, however efficient the ventilating arrangements, will at one time or another, and it may even be said generally, contain some small proportion of fire-damp.

Mines have hitherto been considered free from fire-damp when the search for gas by means of a lamp flame has been unattended by the appearance of a cap upon the flame or by an elongation of the flame. This test, however, fails to indicate the presence of fire-damp, if the atmosphere contains less than from 2 to 2.5 per cent. of its volume of marsh gas.

Such a slight contamination of the atmosphere by fire-damp is not only sufficient to greatly enhance the dangers due to the existence of dust in any abundance in a dry mine-working, as already described, but is also sufficient actually to give rise to the production of an explosive mixture with dust raised in it by a blown-out shot.

Small proportions of gas, such as are referred to, when existing in the atmosphere of a mine, can now be detected, by more delicate gas-indicators than a lamp flame; but, while a knowledge is thus afforded of the presence of gas, it remains impracticable to prevent such slight contamination by fire-damp of the air of a mine near the working places.

It will be seen from the foregoing that such contamination, although quite insufficient to constitute in itself a source of danger, does become dangerous if dust co-exists with it, in abundance, in dry mine-workings, if *powder*-shots are fired in such workings.

No means are at present known by which security can be attained against blown-out shots during blasting in hard coal or in stone, and the use of powder in coal is sometimes attended by the emission of flame, even when blown-out shots are not produced.

It follows from the foregoing that the firing of *powder*-shots in a *dry* mine-working where dust exists in abundance must always be liable to be attended with disastrous results if the air in such a locality is contaminated by fire-damp, even to so small an extent as in the

proportion of 2 volumes in 100 volumes of the air of the mine.

The constant removal of accumulating dust from the workings in *dry* mines, to such an extent as to guard against the raising of any considerable quantity of dust where shots are fired, could scarcely be so thoroughly carried out, in any but very exceptional cases, as to constitute by itself an effectual precaution.

The application of water to the laying of dust in roadways has been applied here and there with some amount of success, but the effective adoption of such a measure in or near the working places is in some instances attended with practical difficulties.

Unless very copious watering be resorted to, it would be ineffectual in guarding against the dangers arising from the firing of *powder*-shots in *dry* and dusty workings where the air may contain some small proportion of fire-damp. The employment of hygroscopic or deliquescent salts in conjunction with water has not been found a trustworthy means of maintaining dust in a safely moist condition.

The dangers which attend the firing of *powder*-shots in *dry* mine workings where dust exists in abundance, and where the air may contain even only a small proportion of fire-damp, can therefore not, with our existing knowledge, be effectually guarded against, except by combining the removal of dust as far as practicable with very copious watering.

The obvious inference to be drawn from the foregoing is that a due regard for the safety of those employed in mines, *where the conditions above indicated prevail*, precludes the use of powder, *unless the precautions just specified are effectually applied.*

The results of extensive practical experiments, carried out by ourselves and others, have demonstrated that the abolition of the use of powder, where the conditions above indicated prevail, will not generally involve any formidable inconvenience, because the work which is accomplished by its employment, both in coal and in stone, can now be performed with equal efficiency and at very little, if any, greater outlay, by one or other of the following available alternative means:—

a. In some coal-seams the lime-cartridge will perform work quite equal to that accomplished with powder, at no greater cost, and with absolute immunity from risk of explosions.

b. Mechanical appliances exist which will do efficient work, not only in some kinds of coal, but also in some stone or shale over or under lying coal.

c. The so-called "high" or violent explosive agents, which are represented by dynamite or gelatine-dynamite and by gun-cotton or tonite, can now be applied, not only for working economically in stone or shale, but also for coal-getting, by using them in conjunction with water, according to one or other of the methods described in this report.

The "high" explosives may be used, as indicated in *c*, with security against the ignition of coal-dust, thickly suspended in air, by a blown-out shot or by the effects of an overcharged hole, even when the air contains small proportion of fire-damp.

One very simple method of using the "high" explosives in conjunction with water, included in *c*, which may be supplemented by the use of ordinary tamping for securing the best working results, has, so far as several severe tests have shown, afforded a complete safeguard even against the ignition of an explosive mixture of fire-damp and air by a blown-out shot.

Therefore, in *dry* mine-workings, where the removal of dust, combined with copious watering cannot be carried out, and where neither of the alternative methods *a* and *b*, of working in coal or stone can be advantageously substituted for blasting by means of powder, in locating where fire-damp is liable to have access to the mine-workings, shot-firing may be safely carried on, provided that any one of the "high" or violent explosives is employed, in one or other of the modes described, in substitution for powder.

But the methods of operation which furnish effective safeguards when applied in conjunction with the high explosives, fail to furnish such safeguard when applied, in the same way, together with *powder*.

Unless, therefore, effective measures be adopted for the removal of dust, as completely as practicable, in the vicinity of the place where the shot is to be fired, such removal being followed by copious watering, the employment of powder, or of any explosive preparation of a similar nature to powder, should be prohibited in dry coal-mines where fire-damp may pervade the air, and where at the same time coal-dust accumulations are unavoidable.

With the view of promoting security from accidents under circumstances where blasting may be practiced in coal-mines we would recommend that the following instructions be observed:—

1. That all work involving blasting in mines should be entrusted only to experienced workmen.
2. That, in order to lessen the risk from blown-out shots, particular care should be taken that each shot should be assisted by under-cutting and nicking or shearing whenever it is practicable.
3. That the tamping, stemming, or ramming should consist of a very damp or noninflammable material.
4. That, where strong tamping is needed, the compression of air at the bottom of the hole should be avoided by pushing the first part of the tamping in small portions.
5. That, where safety lamps are used, and powder is employed, the shots should be fired only by specially appointed shotmen, who before firing the shots shall satisfy themselves that the foregoing instructions are observed, and shall also satisfy themselves, by carefully examining all accessible contiguous places within a radius of twenty yards of the shots to be fired, that fire-damp does not exist to a dangerous extent.

The employment of the ordinary miner's fuse, which, when burning, is liable to allow fire to escape from its extremity or laterally into the atmosphere, should not be permitted in any mine-workings where the exigencies of safety dictate the exclusion of powder and the substitution, for it, of one or other of the "high" explosives in conjunction with water.

Similarly, no description of mining fuse, however safe in itself, should be allowed to be ignited, in such localities, by means either of a lamp-flame, or of a wire which has been made red-hot by inserting it into the gauze of a safety-lamp, or by means of any other source of fire, which, when applied to the lighting of the fuse, must come in contact with the atmosphere of the mine.

Electrical exploding appliances present very important advantages from the point of view of safety, over any kind of fuse which has to be ignited by the application of flame to its exposed extremity, as the firing of shots by their means is not only accomplished out of contact with air, but is also under most complete control up to the moment of firing. Their simplicity and certainty of action have been much increased of late years, while their cost has been greatly reduced, and but little instruction is now needed to ensure their efficient employment by persons of average intelligence.

For the foregoing reasons the use of electrical arrangements for firing shots in mines, where the employment of powder for blasting is inadmissible, should be encouraged as much as possible.

Where the regular use of electrical exploding appliances is attended with serious difficulties, as in wet mines, a special form of miner's fuse, now procurable at a cost very slightly, if at all, greater than that of the ordinary miner's fuse, and exempt from the defect of a possible lateral escape of fire, should be employed, but it should be used only in conjunction with a special self-contained igniting arrangement. Such an appliance should be constructed to fit over the entire exposed end of the fuse in a shot-hole, and to ignite the fuse out of contact with air, and after the lapse of a definite interval (*i. e.*, five minutes), from the time when it has been set into action by the person in charge of the shot firing. Simple, cheap, and efficient forms of "igniter" have been devised, which fulfill these conditions.

It has been shown that mines which have hitherto been considered free from fire-damp may have the air which passes through them vitiated to an extent corresponding to about 2 per cent. of its volume of marsh gas. The air in many such mines may probably never be entirely free from explosive gas, at all events in the neighborhood of freshly cut faces of coal and in the return air ways.

It has been demonstrated in our experiments that when the atmosphere contains 5 to 5.5 per cent. of marsh gas it becomes highly explosive. We have even obtained explosions which, though less violent, might be nevertheless destructive of life if they occur, on the large scale possible in a mine, when the air contained only 4 per cent. of marsh gas.

It will thus be seen that air which would appear free from gas if tested in the ordinary way may become, by the addition of only about 2 per cent. of marsh gas, capable of propagating flame and causing destruction, while the addition of about 3 per cent. converts it into a highly explosive mixture.

As we have already pointed out, air which would appear quite free from gas if examined by a lamp-flame may become explosive when laden with fine, dry coal-dust.

It has been stated that appliances now exist by which very small proportions of marsh gas in air may be readily detected, and which can be used for examining the atmosphere of a mine. With Liveing's indicator, gas present in the air can be estimated with sufficient accuracy for all practical purposes, even when the proportion is as low as 0.25 per cent. Maurice's indicator is also capable of giving accurate measures of the proportion of gas, and is very portable, but the time required in taking an observation with the instrument in its present form seems to preclude its practical application.

The natural inference from the foregoing is that some mines hitherto considered safe with naked lights may at times be in peril.

It may be that risks of explosion, arising out of the possibility of an unforeseen contamination of the air by fire-damp to a dangerous extent in parts of the workings of some Coal Mines, can only be provided against by the invariable use of safety-lamps. We have not however, considered it advisable to make a suggestion of this nature, because the great preponderance of casualities due to falls of stone and coal, over those arising from explosions, points to the importance of miners having the advantage of the superior illumination

afforded by naked lights in comparison with even the best forms of safety-lamp, when the circumstances of the mine, in regard to association of fire damp and coal dust, do not necessitate the use of safety-lamps.

We have therefore arrived at the following conclusions:

1. That it is most important that all mines should be carefully examined by means of indicators capable of detecting as small a proportion as 1 per cent. of gas; such examination to be made before the commencement of each day-shift, and, in case of an interval, also before the succeeding shift.

2. That in all *dry* mines where the air may be laden with coal dust, and where fire-damp is either known to be given off from the strata or may from experience be reasonably suspected to exist, the Secretary of State may require safety-lamps to be used, unless the owners and workmen of such mines prove, to the satisfaction of a court of arbitration to be appointed by the respective parties, that less liability to accident, generally, will be involved by the working of the mine with open lights than by the use of safety lamps. It should be a special instruction to such Court that the circumstances of each mine be taken into consideration with reference to the following points:

(*a.*) The mode of working.

(*b.*) The nature of the coal seams and of the roofs and floors of the seams and of the adjacent strata.

(*c.*) The proximity of the seams to each other.

(*d.*) The emission of gas from the seam, and the liability to blowers or outbursts of gas from the coal, roof, or floor.

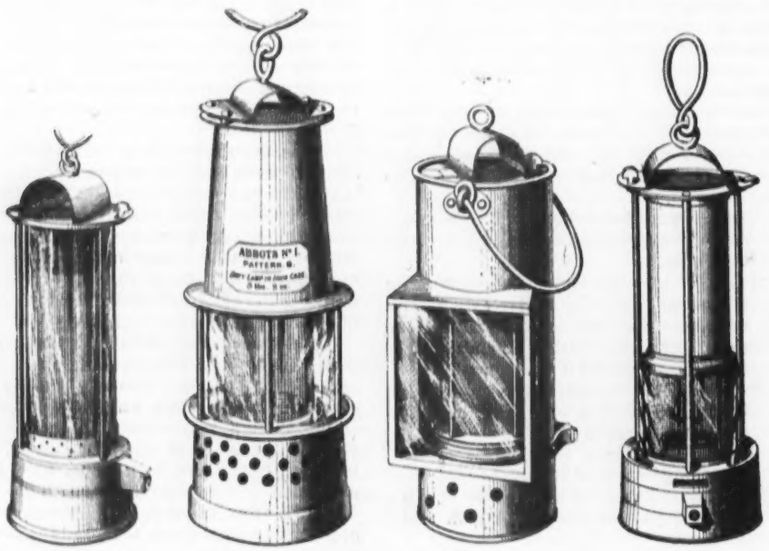
(*e.*) The order of working the seams of coal.

For the system which prevails in some places of working with mixed lights, that is, with open lights and safety-lamps intermixed in the same set of workings, there is no justification, and this practice should be strictly prohibited.

We are of opinion that, in mines where safety-lamps are required, the position of lamp stations, or places where open lights are allowed, in reference to the possibility of access of vitiated air, should receive much more attention than at present. It is desirable that, at convenient places near the working faces, reserves of lighted and locked lamps be kept available for exchange with those extinguished in the workings.

It has long been known that if the atmosphere become inflammable the Davy and Clanny lamps, and in a less degree the Stephenson lamp, are unsafe in currents having velocities much below those encountered in well ventilated mines. Our experiments fully confirm this. The ordinary Davy lamp becomes unsafe before a velocity of 400 feet per minute is attained. The ordinary Clanny lamp will almost certainly cause an explosion in a current having a velocity of 600 feet per minute. A Stephenson lamp will frequently cause an explosion in a current with a velocity of 800 feet per minute.

From the information supplied to us by Your Majesty's Inspectors of Mines and others, currents having velocities of more than



DAVY WITH GLASS SHIELD. 3. | DAVY IN CASE. 1. | DAVY IN CASE. 3. | DAVY IN CASE. 8.

400 per minute are now frequently found in working places. The currents sweeping long wall-faces have very often higher velocities, in main airways current-velocities approaching 2,000 feet per minute are recorded, and considerably higher velocities are encountered at regulators and in narrow places or when large falls occur.

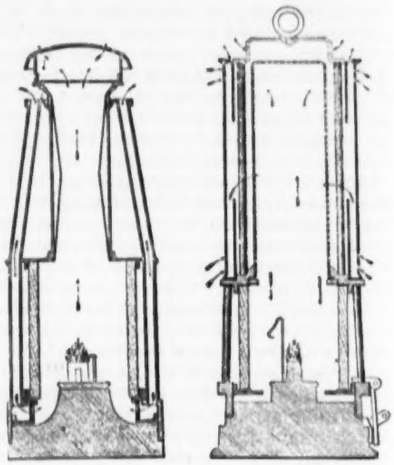
It is thus obvious that, in the present improved ventilation of collieries, ordinary Davy and Clanny lamps have ceased to afford protection from explosion, and that the Stephenson lamp, though more secure than the two former, cannot be relied upon.

We felt it our duty at an early stage of our investigation to draw the attention of the Secretary of State to the danger attending the use of ordinary Davy and Clanny lamps, and our subsequent experiments have made this danger still more conspicuous. We have no hesitation in stating these lamps should be prohibited, unless they are enclosed in cases capable of effectually preventing the gauze from being exposed to the full force of the current of air.

Many lamps now exist which are able to resist, in highly explosive atmospheres, current velocities up to and even exceeding 3,000 feet per minute, at all events for several minutes. Ample time is thus obtained for bring into operation a "shut off" appliance for the extinction of flame produced both by the illuminant and by ignited gas within the lamp.

We consider that all safety lamps should be provided with such an appliance.

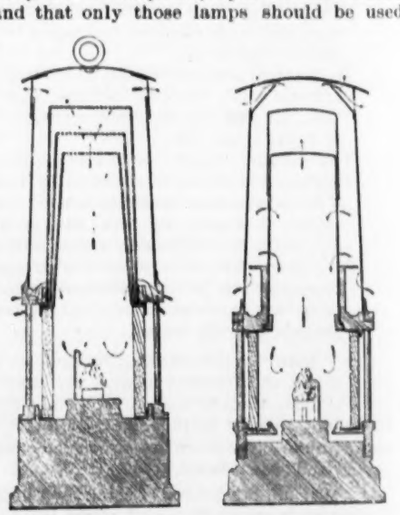
Four lamps seem to us deserving of special attention, as combining a high degree of security with fair illuminating power and simplicity of construction. They are Gray's lamp, Marsaut's lamp, the bonneted Mueseler lamp and Evan Thomas' modification of the bonneted Clanny lamp. In our experiments the last lamp has given upon the whole the best results.



GRAY. 2. | CLANNY. 19.

It will be seen, however, from our experiments that many lamps exist which are simple in construction, and almost, if not quite, as safe as the above. They generally, however, yield an inferior light in consequence of the flame being surrounded by gauze, but from this method of construction they derive the advantage of not being entirely dependent on glass for their security.

To make a particular lamp compulsory would be unwise, as calculated to throw difficulties in the way of introducing improvements which will no doubt arise in the future but we think it desirable that some control should be exercised in reference to the descriptions of lamps employed in coal mines, and that only those lamps should be used which are authorized from time to time by the Secretary of State.



MARSAUT. LEVER COMPETITION .35c. | EVAN THOMAS. 7.

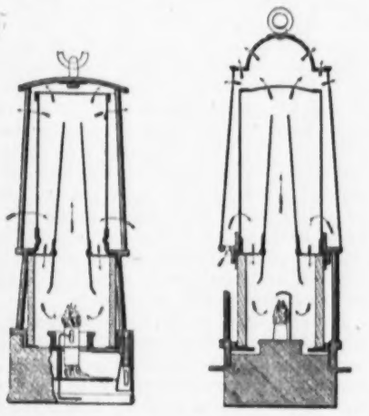
A lamp may be of the safest pattern and yet small defects in the fitting of its parts may entirely deprive it of its power of affording protection. In preparing a large number of lamps for use in a mine it may happen, even

with the greatest care on the part of the lamp men, that a lamp in an imperfect condition may be allowed to pass. The detection of these imperfections by simple inspection is in many cases almost impossible,and we are convinced that the only way of avoiding the introduction into a mine of a dangerously imperfect lamp is to test every lamp in an explosive mixture of air and some inflammable gas before it is allowed to descend the shaft.

Though we have good reason to believe that the practice of surreptitiously opening safety lamps in the workings is much less prevalent than formerly, it is still necessary that such lamps should be locked. We have examined many appliances for this purpose, and we consider that the plan of fastening the oil vessel to the other part of the lamp by a riveted lead plug, impressed at each end with marks or letters varied from time to time, is the simplest, the most efficient, and the one most likely to lead to the detection of any attempt to tamper with the lock.

The power a nd uniformit of illumination given by a lamp can be notably improved by using, as the illuminant, vegetable or animal oil mixed with about one-half of its volume of a petroleum oil of safe flashing point.

The use of petroleum spirit or benzene as the illuminant in safety lamps, instead of



MUESELER LAMP
AUTHORIZED PATTERN IN BELGIUM.

SMETHUPSTS MUESELER

vegetable or animal oil, is attended with some advantages, but it is also liable to introduce new sources of danger. Special care is needed in the filling and trimming of lamps, and in the arrangement of lamp rooms, to avoid the ignition of the highly explosive mixture formed by air with the vapor arising from this spirit.

The selling of petroleum spirit, or of spirit of similar character as to volatility, under designations which are calculated to mislead in regard to the nature of the illuminant, is a proceeding fraught with danger unless all vessels containing such illuminants bear a prominent label, indicating the dangerous nature of their contents.

Stringent regulations as to the conditions under which illuminants of this class are to be used and stored, are absolutely necessary.

The advantages in point of convenience and efficiency which attend the employment of electric glow-lamps for illuminating the pit's bottom, and roadways immediately adjacent to it, have already been demonstrated at several collieries, where this utilization of the electric light has been combined with illumination at the surface by arc lights.

In applying electric glow-lamps to underground illumination, to the extent indicated, through the medium of conducting cables leading from the generators to the pit bottom, it is essential to safety, as well as to the permanent efficiency of the installation, that the cables should be placed in positions where they are thoroughly protected against possible accidental injury. It is also essential, in all mines where fire-damp has been known to occur, that the glow-lamps should be excluded from direct contact with the air of the mine, in one or other of the way indicated in this report.

Portable, self-contained electric lamps have been devised, which will furnish, for several successive hours, a light considerably superior to that of the best safety lamps, and which, at the expiration of eight hours and upwards will still give a light fully equal to that of a freshly lighted Davy lamp. These lamps are perfectly safe, but, as they do not afford any indication of the condition of the atmosphere in a mine, their employment, even if special fire-damp detectors are used, cannot, in any case, entirely dispense with the necessity for the use of some safety-lamps.

For exploring purposes after accidents, or in foul places, these lamps must prove very valuable even in the present condition of their development, and as auxiliary lights they cannot fail to prove very useful. The great progress which has recently been made in the construction of portable electric lamps affords promise of a speedy utilization of such lamps to an important extent in coal-mines.

Whilst we think that the safety-hooks at present available may have contributed to prevent fatalities from over-winding, we believe that the best appliance for the purpose is an automatic steam brake attached to the winding-gear, and we think it desirable that such brake should be introduced where practicable.

We consider that measures should be adopted to deal more systematically, and if possible more expeditiously, with casualties resulting from the various sources of accidents dealt with in this report.

Collieries or mines should be required to provide an ambulance and stretchers for the purpose of conveying to their homes sufferers from injuries received while in the discharge of their duties.

Arrangements should be made for the establishment of centers in mining districts, where additional appliances for exploring purposes, should be maintained in an efficient condition, so as to be ready for use at the shortest notice.

It is most desirable that facilities should be afforded for the instruction of men in the use of special auxiliary appliances for succor and relief, and also special appliances for exploring purposes,and in simple measures connected with the provisional treatment of injuries.

We attach great importance to the systematic inspection of each mine by the workmen, as provided for in General Rule 30 of the Coal Mines Regulation Act, 1872, and we recommend that this provision should be generally and regularly acted upon.

WARINGTON W. SMYTH,
CRAWFORD AND BALCARRES,
GEORGE ELLIOTT,
F. A. ABEL,
JOHN TYNDALL,
THOMAS BURT,
R. B. CLIFTON,
W. THOMAS LEWIS,
LINDSAY WOOD,

March 15, 1886.

A NEW channel between the Wallabout and Whitney basin at the navy yard has been cut through, and is now seventeen feet deep. The channel, when completed, will be of a uniform depth of twenty-five feet, and will accommodate the largest war ships.

Wood Pavement for Courts and Stables.

The *Journal d'agriculture pratique* gives the following directions for preparing and laying wood pavement in courts, stables, store houses, etc. It claims that the results obtained are excellent :—

Blocks of very dry pine were cut, (red Swedish pine preferred) about 9 × 3-inches by 4-inches deep. Then a bath was prepared by adding 6¾ pounds of sulphate of copper to 22 gallons of water. When the sulphate had dissolved the wood blocks were put into the solution and allowed to remain there for eighteen days; they were then taken out and allowed to dry in the shade. For the soaking of further blocks from one-third to half an ounce of the sulphate of copper for each gallon of water was added after each lot impregnated.

In this condition the wood blocks could be used without further preparation. But is much better to dip them in tar, which is done in the ordinary way and they must be allowed to dry before being used.

These blocks should be placed on a 4-inch bed of beton well levelled and then covered with a coat of cement mortar. When the beton is set the blocks should be laid with intervening spaces of ¾-inches into which should be poured a liquid mortar made of three parts sand to one of Portland cement well broomed into the joints. Finish with a coat of sand and in a week the floor is ready for use.

Antidotes for Poisons Resulting from Chemicals used in Manufacture.

The *Moniteur des produits chimiques* gives the following remedies as a first resource in cases where employés are poisoned by absorbing or being burned by the chemicals named :—

1. For phenic, sulphuric, muriatic or nitric acid, creosote, tincture of iodine or phosphorus, use the white of an egg well beaten in water and a teaspoonful of mustard in warm water. In a case where the person has swallowed sulphuric, muriatic or nitric acid, lime should be taken diluted in as little water as possible.

2. For chromic acid, the chromes and colors with a chromic base, preparations with a base of antimony, as tartar emetic, the compounds of copper, mercury or zinc, employ the white of egg in abundance; mustard as an emetic will be almost useless if the poisoning is due to tartar emetic, or take a large teaspoonful or so of the tea of sea-weed (*the d'herbes marines*).

3. For ammonia, soda, potash, alkaline silicates and sulphydrates, use vinegar and follow with oil or milk.

4. For prussic acid and its salts, cyanide of potash, mercury, sulphocyanurets, oil of bitter almonds, or nitro-benzine, pour fresh water upon the head and spinal column, put mustard upon the soles of the feet or the stomach; do not permit the patient to sleep.

5. For ether, petrol, benzole, essence of fruits concentrated alcohol, take a very strong mustard emetic with plenty of warm water; cold bath, fresh air; keep the patient awake.

6. For compositions of barytes and lead, use the mustard emetic with warm water, or epsom or glauber salts in water.

7. For arsenic and its compounds, use the mustard emetic, dyalized iron with magnesia, then follow with oil, milk or mucilagenous liquids.

8. For oxalic acid and its salts, use lime, or the water of lime, and then castor oil.

9. For nitrate of silver, employ common salt dissolved in water and then a mustard emetic.

10. For the nitrous vapors arising from the manufacture of nitrate of iron or sulphuric acid, take acetic acid as strong as can be endured in small quantities.

A New Single-Chain Excavator, Dredger, and Elevator.

Very successful experiments have recently been made with Jessop's Improved Single-Chain Excavator, Dredger, and Elevator, at the Shipley Collieries, Derby, where, according to the testimony of the manager, Mr. C. Sebastian Smith, a very satisfactory and economical piece of work was done in a short space of time by its aid.

The purpose for which it was employed was the removal of the slack and other *debris* from the sump at the bottom of the Coppice Pit, and in six hours no fewer than 60 tram loads of stuff were raised most economically, and without removing the water, at a total cost of under $15, the depth of the shaft in this case being 200 yards. The dredger or grab was worked loose in the pit without guides, being attached to the ordinary wire rope from the main winding engines.

Looking at the diagrams before us, Figs. 1 and 2, we have to consider two views of the machine—viz., the former, as exhibiting the bucket in lowering opened, and the latter, in lifting closed. In order the better to show its adaptability to existing machinery, it must be observed that the arrangement consists of two parts:

(1) The suspending crown with its two chains, which may be attached to the jib-head at a fixed height of discharge, or may be made with a varying gear, by means of a small barrel, which is altogetner independent of and placed slightly above the main barrel on the jib, and is worked by a ratchet handle; and (2) the bucket or grab itself, which is connected by the main chain for lowering and raising. The action of its arrangement is thus briefly described:—The weight, being lowered on the tines or edges of the open bucket, unlocks it; the lifting is then commenced, which first closes the jaws and afterwards lifts the bucket and its contents. This is continued until the catches (on the crown) suspended from the jib-head engage with the triggers on the bucket; the lifting motion is then thrown out of gear, and the chain lowered by the brake; this opens the bucket, discharges its contents, disengages itself from the suspending chains, and renders it ready to make another lift.

FIG. 1

FIG. 2

Various designs of buckets or grabs are constructed for the special kinds of material to be dealt with, and in four different sizes, ½, ¾, 1, and 1½ cubic yards capacity, which are calculated to raise at the least (provided always the power is ample) quantities of mud from 25 to 75 tons per hour, and of clay, 15 to 50 tons per hour, according to the size of bucket and crane power. The machine, which is cheap, combines rapidity and efficiency in working, with great economy. This patent is the sole right of Messrs. J. Jessop and Son, Leicester. Through their Scotch agents (Messrs. Blackwood and Lamb, Glasgow) Messrs. Jessop have lately conducted an experiment at one of the Scotch ports for the benefit of the harbor authorities, and the results proved highly pleasing to all concerned, the dredger (being the identical one used at Shipley Colliery) having raised as much as 57 tons—or 90 buckets—of mud or silt, with a variety of *debris*, in 1¾ hours.—*Iron and Coal Trades Review.*

On the Use of Concrete in Marine Construction.

Although Portland cement concrete has been in use for a number of years, and although there is a large amount of available literature on the subject, it yet appears that in at least one branch of the subject engineers have much to learn. This conclusion is forced upon us by a consideration of the condition of several important sea works constructed of the material during recent years. The appearance of the works in question is such as to make a casual observer lose faith altogether in concrete as a material for sea piers, and although we are satisfied that a hasty generalization of this kind would be a jump to an erroneous conclusion, yet it appears evident that there are limits to the application of concrete and that these limits have been in many instances exceeded. The special cases to which we are going to refer are at Aberdeen, Fraserburgh, and Buckie, three of the most recent harbor works in Scotland.

The south breakwater at Aberdeen was commenced in 1869 and completed in 1873, but only a few years had elapsed before signs of failure were apparent, and soon after an extensive scheme of renewals was required and commenced. The failure of the work showed itself in two separate ways, and proceeded from distinct causes. The pier consisted of concrete blocks built dry up to about low water, and solid concrete deposited *in situ* above. In heavy storms the falling wave on the seaward side allowed air to enter the open joints of the blocks at low water, and as the next wave rose, the air not being able to escape upwards through the solid concrete, exerted sufficient pressure at the back of the blocks on the harbor face to blow some of them out into the harbor. This, combined with an unequal settlement of the foundation of concrete bags, left the superstructure at places without support, and the result was a vertical crack in more than one part of the superstructure. In this way large masses of the upper concrete became detached and had to be removed and replaced. One or these detached blocks was about 100 ft. in length, and must have contained 400 or 500 cubic yards of concrete. The effect of confined air in blowing out stones on the inside of piers built of open-jointed masonry is so well known, and has been illustrated in so many of the old stone piers existing all round our coasts, that it hardly calls for remark, unless, indeed, it be to express surprise that in a modern structure such a failure should be possible.

In addition, however, to the damage done to the Aberdeen breakwater from this cause, there was another defect inherit in the structure which is more particulary the one to which we call attention at present. This is the weakness which has resulted largely in the degradation or wasting away of the concrete by the action of the sea. Starting in places where there has not been a good skin in the first instance, the concrete gradually disintegrates under the action of the waves, the softer, and perhaps badly mixed parts, going fastest, and, of course, as more or less deep holes are made in the work, the interventing portions are likely to give way in large lumps, unless the decay is checked at an early state. At first sight we were tempted to conclude that this wasting of the concrete at Aberdeen was due to some special cause such as the use of dirty sand or imperfect mixing, but further consideration and information dispelled this idea. In the first place, the work was not done by contract, but was carried out under direct superintendence of the engineer; and in the second place, the Aberdeen breakwater is not the only case of the kind. The new Balaclava breakwater at Fraserburgh is similary affected, and so are the new piers at Buckie. The former was finished about five years ago, and the latter a year or two earlier, In both these cases also the work was carried out by the engineer, and not by contract.

The concrete used at Aberdeen was composed of 1 part of cement to 9 parts of gravel and sand. The latter was not always as clean as might have been desired, but it was sharp and large grained, and of a quality which would be accepted for all ordinary engineering works. At Fraserburgh the proportions were also 1 to 9, the aggregate being broken stone

from a quarry near the harbor, and sand from the beach; the stone was a sort of greywacke, hard and strong; the sand uniformly clean and sharp, but rather light in weight. At Buckie the proportions of the facework of the pier were 1 to 7½ of broken stone and sand, large stones being deposited in the concrete while soft; the stone was a moderately hard freestone; and the sand, beach sand fairly clean and sharp.

Of the three cases Aberdeen is certainly the worst.

Now the circumstances force one to the conclusion that the only explanation which will fit all the facts is simply that there was too little cement used. Concrete containing only one-ninth of cement may be strong enough for covered foundations or backing, but the state of these piers seems to indicate that it is much too weak for a face exposed to the sea. The strength of concrete varies (within certain limits) very nearly in direct proportion to the amount of cement used, that is to say, 6 to 1 concrete is as nearly as possible twice as strong as that of 12 to 1; and to curtail the cement is false economy, particularly in sea works, where the cost of cement is a very small proportion of the total outlay. Some engineers, having already taken alarm at the state of the piers to which we have alluded, are facing all their sea work with stone (as, by the way, is being done with parts of the Buckie piers), but it does not appear that this is necessary. If stone can be got cheap it may be worth while, but it need not be supposed that concrete cannot be made which will withstand the action of the sea. We have seen concrete blocks, which have been exposed to a very heavy sea for fifteen or twenty years, to all appearance as hard and sound as blocks of granite. But they were not of 9 to 1 concrete. Using concrete with too little cement is like using a soft and friable stone; such stone may be good enough where it is covered up or protected by a harder material, but no engineer would choose such a stone to face a sea work.

It may be remarked also that in most of the marine works which we have visited in recent years too little attention is paid to the value of a good skin to concrete. In ordinary situations no doubt this is a minor consideration, but in any work exposed to the continued action of water it is of the highest consequence, and is a point which should receive careful attention. Once the skin has given way, disintegration proceeds more rapidly, and particularly if the concrete has been made with gravel or ballast. A round water-polished pebble is much more easily dislodged from its bed of cement than an irregular piece of broken stone, both because of its shape and because the adhesion of the cement is so much less. It may be taken for granted that a concrete made of hard broken stone such as granite or trap is better than that made from ballast of the same proportions. The best sand is the sharpest, other things being equal, and the same may be said of the larger aggregates.

This question of skin tells in favor of using blocks rather than concrete *in situ*; with blocks made on land it is easy to insure the most perfect face, but in work carried out under the periodical action of tides or currents or occasional disturbance from storms, it is a much more difficult matter. But even in such cases it is possible to make a fair skin, and the result is well worth extra trouble.

Harbor engineering at the present day may almost be said to be a disgrace to the profession; what with mistakes of plan or section, resulting in the works being demolished by storms, rendered useless by silting, or being inaccesible to vessels in certain states of wind or weather, and mistakes in construction—such as this matter of concrete—requiring early and heavy renewals, there are very few modern harbors on our coasts which can be referred to with pride or satisfaction. Perhaps we do not make more glaring errors than our grandfathers did, but we seem to have advanced very little. We use concrete where they used stone; their stones washed out one by one and our concrete rots away. We can build piers in sheltered situations which may not be demolished by the first storm, but then the probability is that the inclosure will be choked with sand in a few years. What progress have we made? *Engineering.*

The First Permanent Tramway in America.

Dr. Robert Patterson Robins, in the last number of the Proceedings of the Engineers Club of Philadelphia, reproduces from varied sources a very substantial chain of evidence relating to the location of the first permanent tramway in America.

These notes refer to the road constructed in Delaware County, Penna., by Mr. Thos. Leiper, and the evidence as to priority of inception and construction runs about as follows:

In 1790, Thomas Leiper and John Wall, of Delaware county, brought before the Penna. Assembly a project for a canal, intended to cheapen the transport of stone from Wm. Lieper's quarries to tide-water. This scheme was abandoned, owing to local opposition, and Mr. Leiper sought some other method of attaining his object. According to a memorandum book still preserved, he first considered a tramway in May, 1809, and then made an estimate for a railway ¾ miles long from the quarries to tide-water, the track to be of wood and the cost, including the survey, to be $1,592.47. To satisfy himself that the scheme was feasible he employed a millwright to lay a temporary track in the yard of the old Bull Head Tavern, Second Street and Poplar Lane in Philadelphia, which experiment was described as follows in *The Aurora* of Sept. 27, 1809:

> We have the pleasure to inform the lovers of domestic improvements that a satisfactory experiment, at which we were present, was lately made in this city by Mr. Thomas Leiper, of the great utility of railways for the conveyance of heavy burdens—an improvement which a few years ago was introduced into England—as in many cases a cheap and valuable substitute for canals. In the above experiment a railway was laid of two parallel courses of oak scantling, about four feet apart, supported on blocks or sleepers about eight (8) feet from each other. On this railway, which had an ascent of one-and-a-half (1½) inches in a yard, or 2° 23', a single horse, under the disadvantage of a path of loose earth to walk on, hauled up a four wheel carriage, loaded with the enormous weight of 95½ hundred weight, or 10,696 pounds.
>
> We are informed that Mr. Leiper is about to lay a railway at Crum Creek, in Delaware County, for the conveyance of stone, from his quarry to the landing, a distance of about one mile.
>
> ROBERT PATTERSON, Prof. Math. Univ. of Pa.
> CALLENDER IRVINE, Supt. U. S. [Military Stores.]
> JOHN GLENN, Agent for Thomas Leiper.
>
> Being called upon by Thomas Leiper, Esq., to view his newly-made truck wagon fixed on the railway, of about twenty-one yards in length, for the purpose of making experiments, exhibited in the yard of the Bull Tavern, Northern Liberties.
>
> I took the exact acclivity of the said rail or draught way, and found it to rise at the rate of one inch and a half to the yard.
>
> Philadelphia July 31, 1809.
>
> READING HOWELL, Engineer.

Mr. Leiper being entirely satisfied with the success of his experiments, proceeded at once to advertise for proposals to build a railway from his quarries on Crum creek, to the landing at tide-water. He dates this notice September 27, 1809, and says that the survey and estimate of quantities has been made by Mr. Reading Howell, and that the distance is exactly three-fourths of a mile; the superstructure was to be of wood. In the Philadelphia *Aurora*, of October 29, 1809, appears an advertisement by John Boyce, stating that he has taken the contract from Mr. Leiper to build this road, and wishes to engage laborers. Work was at once commenced, and a map of the road is still preserved in the Delaware County Institute of Science; this map is dated October 1, 1809, and was made and signed by John Thomson, the father of J. Edgar Thomson, late President of the Pennsylvania R. R. Co.

This road was finished early in 1810; "the ascents were graded inclined planes, and the superstructure was made of white oak with cross-ties and string-pieces; the cars or trucks were very similar to those now in use, the wheels being made of cast-iron with flanges."* The railway continued in use until 1828, when it was superseded by a canal.

In this connection, it might be proper to state that the *first* tramway in the United States was laid down on the western slope of Beacon Hill in Boston, by Silas Whitney in 1807. But this was only one-fourth of a mile long, and for a purely temporary purpose in transporting gravel for grading certain low lands. The next permanent tramway in point of date to that constructed by Mr. Leiper was the one laid in Nassau, N. H., in 1825; and the third was at the Quincy granite quarries in Massachusetts, built in 1826-27, and the fourth, and by far the most important to that date was the great enterprise at Mauch Chunk, Pa., nine miles in length.

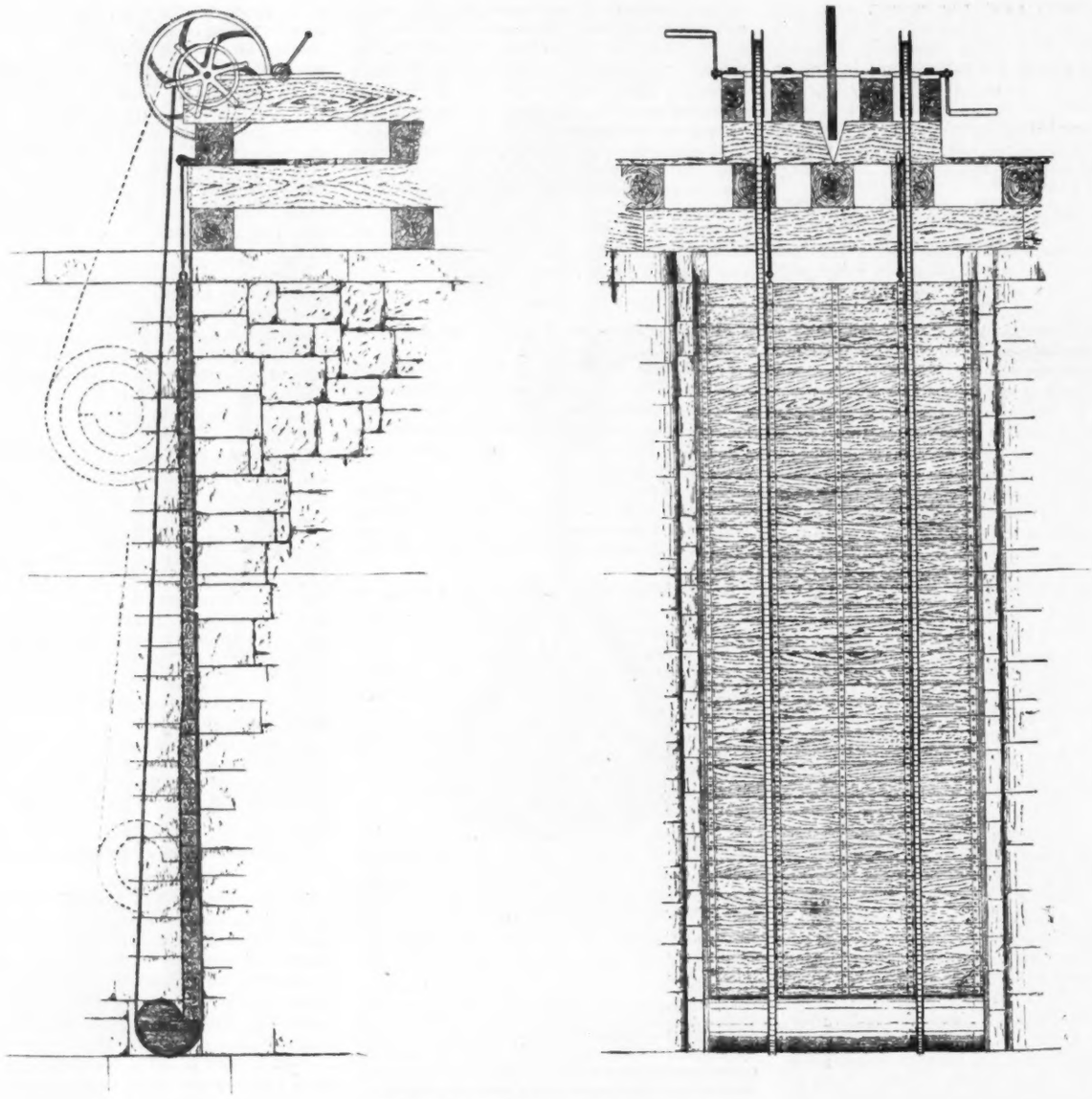
Dr. Robin's account concludes with a very full biographical and genealogical sketch of Thomas Leiper and his descendants. Thomas Lieper died in 1825, aged eighty years.

Preservation of Exposed Ropes.

The preservation of exposed ropes is a matter of great importance when scaffolding remains erected for any considerable time, especially in localities where the atmosphere is destructive of hemp fiber. It has been suggested that in such cases the ropes be dipped, when dry, into a bath containing 20 grains of sulphate of copper per liter of water, and lie in soak in this solution for four days, afterward being dried; the ropes will thus have absorbed a certain quantity of sulphate of copper, which will preserve them alike from rot and from the attacks of animal parasites. The copper salt may be fixed in the fiber by a coating of tar or by soapy water. In tarring the rope it is said to be better to pass it through a bath of boiled tar, hot, drawing it through a thimble to press back the excess of tar, and suspending it afterward on a staging to dry and harden. According to another process the rope is soaked in a solution of 100 grains of soap per liter of water; the copper soap thus formed in the fiber of the rope preserves it from rot even better than the tar, which acts mechanically to imprison the sulphate of copper, which is the real preservative.

THE simultaneous publication in *Scribner's Magazine*, of extracts from the diaries of Gouverneur Morris and reminiscences by Mr. Washburne of the Siege and Commune of 1870, recalls the interesting fact that, at the time of the French Revolution, Mr. Morris, then American Minister to France, was the only one of the entire diplomatic corps who ventured to remain in Paris through the disturbances, and that nearly a century later, at the time of the second great revolution in France, the American Minister, Mr. Washburne, was again the only representative of a first-class power who did not ask for his passports and flee from the city. As these papers show, each of these ministers, by remaining, was able to render great service in extending protection to a large number of citizens of other countries who were residents in Paris.

*Smith's History of Delaware Co. p. 389.



ROLLER CURTAIN HEAD GATE.

Roller-Curtain Head-Gate.

The accompanying illustration shows a head-gate for a high lift, which though in use in France is a novelty in this country. The form of gate shown is proposed by Mr. A. D. Foote, Mem. Am. Soc. C. E., in connection with the canal of the Idaho Mining and Irrigation Company, and differs in dimensions and detail from its French prototype.

As designed there would be six of these gates together near one end of the proposed dam; each gate being 8 feet wide and 24 feet high or deep. The several gates would be separated by piers of cut masonry laid in hydraulic cement and provided with a smoothly cut recess on each side of the up-stream face of the pier for the reception of these curtain gates.

As a vertical lift would be awkward or impracticable, the distinguishing feature in this device is the construction of this gate in such a manner as to permit it being rolled up from the bottom, like a curtain. While the cut explains itself generally, we might add that the curtain is formed of squared timbers—6 × 6 inches in the lower third and 4 × 6 inches above that—joined to each other by strong hinged connections. At the bottom the curtain terminates in a semi-cylinder around which pass two flat chains; the latter running down the back of the curtain, around this roller and then to the drums of the hoisting-gear shown in place above the curtain-opening. The dotted lines show the curtain in two several positions while on its way to the top.

In principle, this curtain is identical with the Caméré hinged curtains used at the Port Villez weir on the river Seine, and described by Mr. Vernon-Harcourt in his late paper on the river Seine read before the Institution of Civil Engineers, (see ENGINEERING NEWS, July 3, 1886.) In this case, however, the curtains were only 3 feet 7½ inches wide by 18 feet long, and when down they abutted against framed iron trestles instead of masonry; the French curtains were also further arranged so as to be entirely detached, and removed on a carriage which also included the hoisting-gear. Mr. Vernon-Harcourt says that the Port Villez weir arranged in this manner cost about $816 per lineal foot, and that the curtains were "worked with ease, and have proved water-tight and durable." The wrought-iron frames, however, did not answer so well as they were liable to deflexion and damage; a curtain could be rolled or unrolled in ten minutes. The article referred to, as reprinted in this journal, gives, other applications of this hinged curtain and its supports.

A SENSITIVE THERMOMETER.—A French thermometer, it is reported has been devised of such sensitiveness that it will even denote by a deflection of the index needle of nearly 2 inches, the entrance of a person in the room where it is placed, and by putting the hand near the bulb the needle is deflected the whole extent of the graduated arc. The apparatus consists of a bent tube, carrying at one end a bulb which is coated externally with lampblack. The tube is filled to a certain extent with mercury, and is supported by arms pivoting on a steel knife-blade. Just above the pivot is fixed an index needle which moves across a graduated arc, and beneath the pivot hangs a rod, to which is attached by friction a small weight that serves to balance the needle so as to cause it to point to zero on the arc. When the temperature rises, be it ever so slightly, the heat being absorbed by the lampblack dilates the air in the bulb and drives the mercury forward. The center of gravity of the apparatus being displaced, the needle will immediately turn toward the right; and when, on the contrary, the temperature decreases, the needle will point toward the left.

CORRESPONDENCE.

British Ordnance Maps.

170 CLINTON STREET, BROOKLYN, N. Y.
December 8, 1886.

EDITOR ENGINEERING NEWS:

Some further details with regard to the maps of the Ordnance Survey than are mentioned in your article on the "British Ordnance Survey" (November 6th), may be of interest to your readers. The scales adopted are 1 inch, 6 inches, 25.344 inches and 5 feet to the mile. The city of London is the only part, I believe, that is mapped to the latter scale. The size of the sheets is about 20 inches by 30 inches, many portions of the 1-inch survey may be obtained in quarter sheets. On the 1-inch scale the topography is shown by contour shading, some of the 6-inch maps have contour lines, but in general the maps are plain, with lines of levels along all the principal roads. Bench marks are shown on all the maps and are very numerous, they are of great value to levelers for checking on, obviating the necessity of check levels; it frequently happens that a line of levels may be started from a convenient O. B. M., checked on others near the line and finished off on yet another, thus ensuring the accuracy of the work. The datum lines of profiles for railroads and other works are frequently referred to a certain distance below a stated O. B. M. Nearly every leveling party is provided with an ordnance map, or a tracing having the main roads, levels and bench marks indicated. By these means, too, an engineer can obtain at once a fair approximate idea of the surface of the country and of the profile of a proposed line.

The maps are beautiful specimens of engraving, and those on the two larger scales show the block plans of all houses, with conservatories, drives, alleys, etc., and the lay-out of large grounds. Some on the 25-inch scale (as it is usually called), are printed in colors. These maps are made use of very extensively for surveys for railroads, sewerage systems, docks and other engineering works, and save much time, since a man will take a section of a map, fastened conveniently to a board, and, provided with a tape, rule and pencil, will walk over the ground, putting in new roads and buildings and making all corrections, so that an accurate map may be obtained without any actual survey or instrument work. Such work may be relied on as the ordnance surveys are made with the greatest care and are checked two or three times by separate parties of engineers.

The writer has done considerable of this work and has had experience of the great assistance that these maps prove in running lines of levels and in preparing maps of the land included within the "limits of deviation" of a projected railroad, for Parliamentary purposes.

The Ordnance Survey is conducted by the Royal Engineers and the maps are prepared, printed and published by the Ordnance Department. The main triangulation is gone over by three separate parties, in order to ensure perfect accuracy, and in towns and cities the filling in is usually done by non-commissioned officers, many of whom are remarkably expert at field and instrument work; in some cases civil engineers and the local surveyors (men who have made land surveying their profession and who know all the country within their neighborhood by heart) are employed for filling in work in the country.

The fields are all numbered and their area, etc., given in a printed Ordnance Book.

The importance of such an extensive and accurate system of survey and maps can hardly be over-estimated.

Yours very truly.
E. E. RUSSELL TRATMAN.

Friction in Hydraulic Presses.

3301 HAVERFORD ST., PHILADELPHIA, Nov. 30, 1886.

EDITOR ENGINEERING NEWS:

Mr. Hick's formula for the friction of hydraulic presses, which you print in your issue of 27th ult., appeared in "The Civil Engineer's Pocket-Book" until the last revision. It was, however, accompanied by the following qualifying clause:

"But a small press by Tangey of Birmingham, under a pressure of but 360 pounds per square inch, showed a friction of 1 per cent., or 4¼ times greater than the above; while other experiments make it equal to the pressure in pounds per square inch × .4 of the depth of the collar in inches × circumference in inches; which is much greater than either. Recent experiments in this country make it in some cases *vastly greater still*; while others by Gen. Q. A. Gilmore confirm Mr. Hicks."

In view of the uncertainty which thus seems to surround the subject, I concluded that it was scarcely worth while to retain the formula, and I accordingly dropped it in re-writing "Friction" for the last edition, which appeared in May of this year.

"The Pocket-Book" also gives a method of triangulation which is almost identical with that suggested by Mr. Wm. W. Blackford in the issue referred to above; making the angle *BAC* 5° 43′ instead of 5° 44′, and giving the distance *AC* instead of *AB*. Mr. Blackford employs the *sine* and we the *tangent*, of *BAC*.

JOHN C. TRAUTWINE, JR.

Ohio Civil Engineers and Surveyors.

EDITOR ENGINEERING NEWS:

The eighth annual meeting of the Ohio Society of Surveyors and Civil Engineers will be held in Columbus, O. January 11th, 12th, and 13th, 1887. An elegant hall, centrally located, with ample accommodations, has been secured. Headquarters will be at the Park hotel.

The programme will be full and very interesting. In addition to the papers and discussions, one evening will be devoted to the exhibition of views of the most remarkable engineering structures in America, by the stereopticon. Most of these views are the same that were exhibited by the American Society of Civil Engineers, at their annual convention at Deer Park, Md.

Indications lead us to expect that the meeting will be unusually interesting, and it is hoped that there will be a large attendance. Surveyors, Civil Engineers, Contractors, Manufacturers of Engineering Instruments, and all who are interested in Engineering works of any kind, are cordially invited to be present. A detailed programme will be furnished at a later date.

Yours truly,
BENJAMIN THOMPSON, *Secretary.*

Urbana, O.

Tables of Quantities.

RUSSELLVILLE, ALA., November 28, 1886.

EDITOR ENGINEERING NEWS:

In the ENGINEERING NEWS for Nov. 20th, Prof. J. B. Johnson states that the tables of quantities in his book are the only ones published containing correct quantities by the Prismoidal formula.

In "Cross' Field Book," No. 2. ENGINEERING NEWS Library, there is a set of tables of quantities but it is not stated whether they are for mean end areas or the Prismoidal formula. On this residency I have cross-sectioned every 50 feet, and, on comparing quantities calculated from mean end areas for 50 feet, I find they agree exactly with Cross' tables. This is, I think a more accurate method of obtaining true quantities than taking cross sections every 100 feet and using Prismoidal formula. Would like to have your opinion.

Yours truly,
S. H. LEA,
S. & B. R. R., RUSSELVILLE, Ala.

LITERATURE.

Supplement to the Steam Engine Catechism: A series of direct practical answers to direct practical questions mainly intended for the use of young engineers and for examination purposes. By ROBERT GRIMSHAW, M. E., etc., New York. 1886. John Wiley & Sons, Publishers. Size 4x6 inches, pp., 195. Price $1.00

The popularity of the catechism proper of Mr. Grimshaw is a sufficient warrant for the publication of this supplementary matter. The present volume contains answers to questions put to the author since his first edition appeared in connection with matters omitted therein; it is intended for use in connection with the original catechism.

Irrigation Development.—A history of the growth and account of the present condition of irrigation laws and regulations in France, Italy and Spain. By WM. HAM. HALL, State Engineer of California. Vol. I; full octavo, 662 pp. State Printer, Sacramento, Cal. Price $2.75, plus 25 cents for postage. Address Thos. L. Thompson, Secretary of State.

The question of irrigation is an all important one to vast areas in our Western States and Territories, and worthy of much more attention in the east. This work of Mr. Hall is an introductory volume to the entire subject in the United States generally and California in particular. It will be completed and published by the State of California in three parts. The first is given in the present title. Part II. will relate to irrigation in California; giving water-sheds, precipitation and water-supply, lands requiring irrigation, irrigation districts, water rights, riparian interests, works, systems, practice and statistics of irrigation in California. Part III will relate to the irrigation question generally; showing its development in California, the Mexican civil law, English common law, California customs, conflicts, questions, irrigation and water-right laws, and a system for California. This Part I relates entirely to foreign practice, but as it details the results of long experience is invaluable in any serious study of the questions involved. This publication is of very timely interest; and as it is a State production, engineers or others desiring to possess the complete set are recommended to secure it at once as the edition is limited.

SELECTED MISCELLANY.

A VERY good proof of the better times is seen in the list of semi-annual dividends payable in Boston next month. Last year they amounted to $4,664,063 and this year to $5,436,355.

A RUSSIAN engineer has discovered a process of reducing petroleum to the form of crystals, which may be easily and safely transported to any distance and then reconverted into liquid form.

WHEN the Brooklyn bridge was opened it was 5,989 feet in length. With the extensions on each side of the river it is now 6,537 feet, and President Howell says that it will continue to grow on the Brooklyn side until Nassau street is reached.

THE cost of policing and maintaining the Brooklyn Bridge is $68,900 per annum. The total running expenses for the year ending November 30, 1885 were $427,276.21; the receipts from all sources for the same period were $721,622.09. During the time that the cars have been running they have made 799,678 round trips, a distance of 1,799,264 miles, which is equal to seventy-five times around the world.

THERE is said to be a good demand in Spain for small vertical engines from ¼ horse-power upwards to 1 horse-power, to drive all kinds of small tools, if they could be supplied at low prices. As regards iron castings, the Spaniards themselves are making headway. They would seem to be able to dispense with foreign make. On the other hand, there are only very few foundries that can turn out anything like true and heavy castings, and these would be dearer than if imported.

THE SUEZ CANAL.—The transit revenue of the Suez Canal Company in the first nine months of this year was 1,720,215*l.*, as compared with 1,898,878*l.* in the corresponding period of 1885, and 1,969,919*l* in the corresponding period of 1884. The number of ships which passed through the canal in the first nine months of this year was 2,386; as compared with 2,820 and 2,611 in the corresponding periods of 1885 and 1884 respectively.

THE ten largest cities of the world, according to the latest estimates are London, which, with its suburbs has a population of 4,764,312; Paris, 2,269,023; Canton, China, 1,500,000; Aitchi, Japan, 1,332,060; New York, 1,300,000; Berlin, 1,122,330; Tokio, Japan, 987,887; Philadelphia, 875,000; Calcutta; 766,298, and Vienna, 726,101. There are several cities in China which claims a population of 10,000,000, but as the claim is not based on any systematic enumeration they are not included in this list.

Mr. Sandford Fleming, of Ottawa, Canada, is reported as saying that a company has been formed in London for establishing a direct telegraphic route between Australia, New Zealand, Canada and Great Britain. The scheme proposes a chain of cables from Brisbane or Sydney to New Zealand; thence via the Fiji, Fanning and Sandwich groups to Barclay Sound, Vancouvers Island; thence to Vancouver City and the Canadian Pacific R. R., possibly, to Gaspe in the Province of Quebec. And from Gaspe a new cable would be laid via the Straits of Belle Isle to Great Britain. The combined ocean cables would be 11,135 miles long, and the distance across the American continent would be 3,450 making in all nearly 15,000 miles. The question is now being considerd by the Government, home and colonial; the Hawaiian Government offers a subsidy of $20,000 annually.

DURING a recent voyage of the U. S. A. Juniata to South America, observations were made as to the height and length of waves, with the following result, as reported by Commander Davis: height of wave from hollow to crest, 25 feet; length from crest to crest, 375 feet; wave-period, 7.5 seconds. The wind-velocity at the time was 10 miles per hour. The height of wave was measured by the elevation at which an observer could see over the crest when the ship was in the hollow. The wave-period was estimated by counting the average number of waves per minute. The wave-length was determined by the time occupied by the crest in passing a measured portion of the vessel's length.

THE article in the January number of *Scribner's Magazine*, on "Our Defenceless Coasts," by Captain F. V. Greene, is noticeable as containing the first clear statement of the plans favored by the best engineers for fortifying New York Harbor. While there has been a great abundance of destructive critical writing on the subject, no definite idea has before this been given to the public as to what it has been proposed to substitute for the existing so-called fortifications.

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AND

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MAGAZINE RENEWALS.

The *Century Magazine* closes its yearly volume with the *October Number*. Renewals are in order for November. The price to ENGINEERING NEWS subscribers and their friends is $3.55; with ENGINEERING NEWS, $8.55. The new *Scribner's Magazine* will be out December 1. Price $2.50 to our subscribers. *Harper's Monthly* is renewable on December 1. Orders ought to be sent in in November to save the publishers trouble.

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THE elevated railways of this city carried 13,214,573 passengers last month as against 8,955,976 in November, 1885. This is an increase of 4,258,597 passengers, or 141,953 per day. Notwithstanding the lower fare, the returns for last month show a gain of $76,589.28 in revenue received. If even the present travel is maintained, and it will doubtless increase, New York will very soon need more rapid transit In fact the morning and evening trains are now very uncomfortably, if not dangerously crowded.

"Of Course! Why Not?"

Under this heading our contemporary, the *American Manufacturer* supports the views of Captain Michaelis and Mr. Wm. Metcalf as to the superiority of cast over built up guns, as follows:—

The time has finally come when our Government should abandon definitely and forever its costly experiments with "built up" guns made on the absurd and unscientific European system now in vogue. The evidence of the absolute non-reliability of guns made on this system, even by the best makers, is overwhelming. The English ordnance board report, concerning the bursting of the Collingwood's 43-ton gun, that this gun "would be specially liable to the setting up of internal strains during the processes of forging or of oil hardening."

After quoting from Colonel Hennebert's statistics showing the numerous failures of Krupp's built up guns, he continues:—

This is what might have been expected. Every steel maker who is not a gun maker, say these large masses cannot be forged so as to be safe from injurious strains.

Every mechanic who is worthy of the name, knows that such masses of rings and tubes cannot be fitted and assembled so as to act as a continuous whole, and even if they were so fitted they could not be retained in that condition after the warming up of the first few rounds.

Why do the guns burst?

Because they are built to burst.

Why do not our highly educated ordnance officers design guns on sound principles?

Because no officer is allowed to design anything that is not laid down in the books, or proven by some one else.

Why? Because of an overpowering fear on the part of every other officer, that that designing officer might have some design for himself of winning a name or earning a promotion, out of the regular order!

Why do not the Chiefs of Ordnance act? Because they dare not; there is no place to shift the responsibility, and they might lose their heads. Only artillery officers are required to lose their heads.

Why does not Congress act?

Because Congress is the most absolutely helpless body in the world against the bureaus.

It is not desirable that Congress should know anything, therefore Congress is not allowed to know anything except such things as it is desirable that Congress should know.

It probably makes very little difference to the country whether our new guns are cast from "low" steel or from the better quality of American gun-iron. Iron has the advantage that we have already been successful in casting guns with it up to bores of 15 and 20 inches in diameter, the problem presenting itself at present being one of increased length and thickness. The adoption of a gun cast from either iron or steel on the Rodman plan, and guns from both metals should be tried, would give us an armanent in less than one third the time we can hope for from built up guns and at less than half the price, and it is not at all certain that we would be unable to get over fifty to sixty effective shots from them, which is about the extent of service to be depended on from the best built up guns.

But the built up gun men are not entirely at peace among themselves. Mr. Dorsey, who does not seem entirely at ease unless he is attacking a belief which heretofore was considered well grounded, wrote some time since to the *Army and Navy Journal* asking why our Ordnance officers selected steel to withstand the shocks incident to the use of artillery which no engineer would put either in a boiler, a bridge or a beam? It is said that this conundrum was shown to Secretary Whitney and by him referred to his Ordnance officers, who so far are not understood to have found a satisfactory answer. Mr. Dorsey, however, has been invited to address the Naval Institute at Annapolis, the 5th. of next January, on this subject, where among other points against the "high" steel now in use for guns it is understood he will refer to the probable effect of the fire from machine guns on the bands of high tension steel. The Maxim gun, it is claimed, will fire over 300 1½-inch bolts, weighing six pounds each, per minute, and it is hardly possible that the impact of one of those shots at an angle of from 30° to 40° on a hoop should not start a crack which would develope rapidly into a break.

Under these circumstances it seems desirable that Congress should know more than they seem to have been allowed to know.

Directions for Making Drawings for Reproduction.

At the request of some of our readers, we repeat the directions given some time ago to those who would make drawings intended for reproduction by the photo-electrotype process:

1. Use a paper with a smooth surface rather than Whatman or other paper with a rough surface. What is called "ledger" paper, smooth, heavy and white, is well adapted to this purpose.
2. Use very black India ink; the prepared liquid India ink is very good and is always ready.
3. Have your drawing-pen in good condition so that the lines are sharp and well defined.
4. Use as few shade lines as possible; or if used let them be sharp and well defined, not too close together, and in cylindrical work decreasing in thickness of line as the light is approached.
5. Make the original drawing at least four times the size of the electro-plate wanted. The work is much improved in appearance by being thus reduced, as the lines are finer, and slight errors in drawing are, to a certain extent, decreased in importance.
6. In this reduction remember that all lettering and figures will be reduced in proportion. Consequently in the drawing this lettering and figure-work should be, say, twice as high as they are intended to appear on the finished plate, in a drawing to be reduced to one-fourth.
7. Draw the scale on the original so that it may be reduced with it. Unless the reproduced plate is to be of *exactly* the same size, the mere mention of the scale has no value.
8. Avoid all brush-shading and color, other than dense black.

By following the above directions, which we believe include all the important points, draughtsmen will save themselves and the plate-makers much trouble. The use of the photo-electrotype process in the reproduction of drawings has become so common that this advice may be superflous to many of our readers; yet there are some who have evidently not yet availed themselves of its many advantages, and to these the above rules are addressed.

Fuel Gas and Electric Lighting.

The problem of cheap fuel, power and light promises to be solved if the combination of three powerful companies with abundant capital and plant can accomplish it. This is to be brought about by the practical consolidation of the Safety Appliance Co. Limited, of Pittsburg, Pa., the Philadelphia Company of the same place and the Westinghouse Electric Company.

The first named corporation has for its main purpose the promoting of heat, light and power companies throughout the United States, whose purpose shall be the economical utilization of gas or electricity. This company now owns all the inventions that have contributed so materially to the successfu

working of the Philadelphia Company, of Pittsburg, which now carries and distributes over 200 million cubic feet of natural gas daily. It will operate in widely separated localities where natural gas has been found, and will seek for and develope this fuel in other sections.

By combining with the Westinghouse Electric Co. electric plant for supplying incandescent light would be also provided. The Westinghouse Co. claims that its process is more economical than those now in use by other American companies; and especially in the amount of main-line wire; and it further proposes to lay its cables underground.

Whatever such a powerful combination may otherwise mean, the fact is apparent that gas-fuel, either from natural sources or made from the mountains of now waste culm, and the electric light will be the powerful factors in advancing our industrial interests and personal comforts in the next decade. Corporations such as these named, do not risk capital and labor unless they feel assured of a strong public demand for their products.

The New Chicago Sewerage System.

Rudolph Hering, Chief Engineer of the improved sewerage and water supply of Chicago, presented to the City Councils, on December 5th, a communication relating to the drainage of the city.

The main object of this document was to secure an additional sum of $20,000 for completing the necessary investigations, the $30,000 appropriated being very nearly expended.

Mr. Hering said that there were three ways in which to dispose of the city sewage. 1. By discharge into the Desplaines river. 2. By discharge on the sand dunes of Thornton Township, Ill., and North Township, Ind. 3. After being clarified by precipitation or strained by forced filtration, it can be discharged into Lake Michigan. He did not consider the last two as worthy of consideration; they would be too expensive and well nigh impracticable.

The first named, which is not new, is the only feasible and rational scheme; but Mr. Hering at present goes no further than to say that the sewage can be disposed of in this manner without detriment to the population residing on the Desplaines or Illinois rivers.

The Efficiency of Ventilating Fans and Blowers.

Reliable data as to the performance of ventilating fans and blowers are so scarce an article in technical literature, that it is refreshing to note in the last volume of the Transactions of the American Society of Mechanical Engineers, just issued, two independent experimental records of the power required to drive such fans and blowers, which, communicated by two trustworthy and well-known engineers, are certainly entitled to some consideration and weight.

On page 539 of the Transactions, Vol. VII, Prof. Wm. P. Trowbridge, of the School of Mines, Columbia College, contributes a record of experiments made with the Blackman fan, by Mr. George A. Suter, M. E., Engineer of the New York Exhaust Ventilator Company, to determine the volumes of air delivered under various conditions, and the power required. The Blackman fan belongs to the class of disc-fans. The experiments were made with a fan, 4 feet in diameter, and the apparatus was so arranged that the air was drawn and forced alternately through a metallic tube 30 feet long and 4 feet diameter, the fan being mounted at one end of the tube. The power of the engine driving the fan was determined by the steam engine indicator, the volumes of air delivered being determined at the same time by an anemometer.

The first five columns of the following table are contributed by Prof. Trowbridge, as the record of Mr. Suter's work, while the succeeding six columns are the contribution of Mr. George H. Babcock, President of the Babcock & Wilcox Boiler Company, in the discussion following the reading of the paper.

Table of Experiments With Blackman Fan, With Calculations of Efficiency, and Ratio of Increase of Power to Increase of Velocity.

Revolutions per Minute.	Cubic Feet of Air per Minute.	Horse-Power.	Head (h.) in Inches of Water.	Nature of the Experiments.	Ratio of Increase of Speed.	Ratio of Increase of Del'ry.	Ratio of Increase of Power.	Exponent x, $H. P. \propto n^x$	Exponent y, $h \propto n^y$	Efficiency of Fan.
350	25,797	0.65		Drawing air through 30 feet of 48-inch diameter pipe on inlet side of the fan.						1.682
440	32,575	2.29								.9053
534	41,929	4.42			1.186	1.287	1.843	2.4		1.062
612	47,756	7.41			1.146	1.139	1.677	3.97		.9358
For Series					1.749	1.851	11.140	4.		
340	20,372	0.76		Forcing air through 30 feet of 48-inch diameter pipe on outlet side of the fan.						.7110
453	26,660	1.99			1.332	1.308	2.618	3.55		.6063
536	31,649	3.86			1.183	1.187	1.940	3.86		.5205
627	36,543	0.47			1.167	1.155	1.676	3.59		.4802
For Series					1.761	1.794	8.513	3.63		
340	9,983	0.12	0.28	Drawing air through 30 feet of 48-inch pipe on inlet side of the fan, the pipe being obstructed by a diaphragm of cheese-cloth.						.3939
430	13,017	0.17	0.47		1.206	1.304	2.837	3.93	1.95	.3046
534	17,018	6.07	0.75		1.242	1.307	1.915	2.25	1.74	.3319
570	18,649	8.46	0.87		1.068	1.096	1.394	3.63	1.60	.3027
For Series					1.676	1.704	7.554	3.24	1.81	
330	8,399	1.31	0.26	Forcing air through 30 feet of 48-inch pipe on outlet side of fan, the pipe being obstructed by a diaphragm of cheese-cloth.						.2631
437	10,071	3.27	0.45		1.324	1.199	3.142	6.31	3.06	.2188
516	11,157	6.00	0.75		1.181	1.108	1.457	3.66	4.96	.2202
For Series					1.563	1.329	4.580	8.35	3.72	

In calculating the efficiency, Mr. Babcock figured on the basis of the ratio of work actually done to the horse-power expended, making no allowances for friction in the pipe or fan, or for contracted vein at the entrances. He concludes that the first four experiments are evidently the subject of some error, because the efficiency is such as to prove on an average that the fan was a source of power sufficient to overcome all losses and help drive the engine besides; that the second series is less questionable, but still the efficiency in the first two experiments is larger than might be expected, and finally he points out that in the third and fourth series, as would be expected, the resistance of the cheese-cloth reduced the efficiency largely.

On page 822 of the Transactions, Vol. VII, Mr. H. I. Snell, of Philadelphia, presents the following record of:—

Experiments Made With a No. 6 Red Pressure Sturtevant Fan.

Revolutions of Fan per Minute.	Area of Discharge Opening, in Square Inches.	Pressure Obtained, in Ounces per Square Inch.	Horse-Power.
1,519	0.	3.50	0.80
1,480	10.	3.50	1.30
1,471	20.	3.50	1.95
1,485	28.	3.50	2.55
1,483	36.	3.40	3.10
1,465	40.	3.25	3.30
1,451	44.	2.88	3.50
1,468	44.	3.00	3.55
1,426	89.5	2.38	4.80

The fan-wheel of this blower was 23 inches in diameter, having a width at its periphery of 6¾ inches, and a diameter or inlet on each side of 12½ inches, with eight blades, each blade having an area of 45.59 square inches. In referring to the above table Mr. Snell specially points out how running the fan at a speed of 1,468 revolutions per minute, it took 3.55 horse-power and gave a pressure of blast of 3 ounces to the square inch, the area of discharge being 44 square inches, and the volume of air delivered 2,750 cubic feet per minute, while when the opening was closed and the volume of air delivered nothing, 0.8 of one horse-power were required to give the blower about the same speed, viz.: 1,519 revolutions, and cause a pressure of 3.5 ounces per square inch.

Commenting on this fact, Mr. Snell related a rather amusing experience at the Centennial Exhibition, when he was in charge of Mr. Sturtevant's exhibit. He was running a No. 12 fan, with 3-inch single leather belt, when "a gentleman well-known in the mechanic arts and for whom 'he' had a great deal of respect, though 'he' never had met him before, came to 'him,'" and wishing to ingratiate himself somewhat with the gentleman, Mr. Snell said: "You see that I am running that fan with a 3-inch belt."

He replied: "Yes, but you have your opening wide open, you have no resistance." The discharge opening was 3 feet square. Mr. Snell "closed the opening immediately and showed him that the fan would run away with itself."

New Croton Aqueduct Commission.

At the stated meeting of November 24th, the committee on construction, after reading the opinions of the counsel to the corporation referring to the power of the Commissioners to enforce proper lighting and ventilation of the tunnel and shafts, offered a resolution, which was finally passed, employing James T. Gardner, engineer to the State Board of Health, and William McQuale, mining expert, to examine and report upon existing conditions of light and ventilation, and to suggest improvement when needed. A resolution, or rather amendment, to prohibit the use of gasoline on the works was lost, as also another limiting the time of investigation by the experts to two weeks, and their expenses to $500.

A resolution offered by Gen. Newton was also passed directing the Chief Engineer to give an account of the light and ventilation on each section of the work, and to note whether these are in conformity with the instructions of the Commission. An extra Shaft No. 13 A, was authorized, and work suspended on Shaft No. 13½ until further orders.

The Use of Salt for Melting Snow in Paris

M. Barabant, Chief Engineer of bridges and roads, has a note upon the use of salt in removing snow, in the September number of the *Annales des Ponts et Chausses*. We abstract as follows:—

In 1880 Chief Engineer d'Ussel contributed to the *Annales* a paper upon this subject, and estimated that from 50 to 75 grammes (1.76 to 2.64 ounces) of salt would be required for each square metre (1.2 square yards) of surface one centimetre (0.39 inches) deep of compacted snow; and that salt then cost 220 francs ($44.00) per ton. But even then he showed that there

was an advantage in its use over ordinary means for removing snow in Paris.

Since 1880 considerable progress has been made in this direction, and in Paris, in the winter of 1885-86 the city consumed about 4,000 tons of salt in removing snow and ice. While this work has at times heavily taxed the municipal treasury, this innovation has undoubtedly lessened these expenses and decreased the number of accidents to man and beast.

The idea of melting snow by the use of salt and substituting an easy sweeping of a liquid material for a difficult scraping is not new But until lately in Paris the *octroi* and other duties upon salt made its use almost prohibitory; to salt worth 31 *f.* 40 ($6.28) per ton in the depot at Paris the total duties added a further sum of 157 *f.* ($31.40) per ton, or making it cost to the consumer $37.68 per ton. After spending nearly a $1,000,000 in the winters 1879-80 and 1880-81 for the removal of snow the City of Paris succeeded in persuading the minister of finances to reduce the tax on pulverized salt not intended for domestic use and intended solely for use in connection with snow removal. This same privilege was extended to the omnibus, tramway and railway companies of Paris; and the same practice has been followed in other large cities of France, some of which, however, require about one per cent. of powdered soap to be added to the salt thus exempted from duty with a consequent increase of $2.00 per ton in the price of salt.

The salt used on the streets should be in grains .07 to .12 inch in diameter, and the fine grains passing a No. 25 seive should not exceed 30 to 40 per cent. of the volume. The salt should be stored in covered and dry places, and so disposed will keep from year to year.

In Paris the snow-removing force is thoroughly organized and the laborers promptly appear at designated centers at whatever hour of the day or night that snow appears. For the great end is to attack it as soon after its fall as possible and before it can be packed by the wheels of vehicles. The salt is spread as soon as any amount of snow commences to fall, as the mixture of salt and snow is then assisted by the traffic. At the end of four or five hours when the snow is liquid, the succeeding processes are as follows:

1.—Sweep the roadway with a machine and lay the pavement bare.

2.—With the rubber squilgee clean off the sidewalks.

3.—By the use of water wash the liquid mass into the sewers, and thus avoid the excessive cost of transport. The freezing mixture causes no damage whatever to streets paved with asphalt, bitumen or wood. But the use of salt should be forbidden on stone pavement as this disintegrates under the influence of this successive artificial freezing process. On macadamized pavements also this application will not work as such streets become muddy and the amount of sand conveyed to the sewers is excessive.

The freezing slush is doubtless destructive to the shoe leather of pedestrians and injurious to horses; but the first trouble is reduced at least by applying the salt only at night and the application of grease to the hoofs of horses prevents cracking under the action of the intense cold.

As to quantity used, about 20 grammes per superficial metre for each centimetre in depth of snow seems a fair average. This is about $\frac{5}{16}$ ounces of salt for each square yard of surface $\frac{1}{16}$ inch deep. In 1879-80, with old removal methods, each half-inch of snow falling in Paris cost 60,000 *f.* ($12,000); this expense is now reduced to 20,000 *f.* ($4,000).

The application of direct heat to snow removal has failed, as under this process a liquid is produced which rapidly changes into ice at a comparatively short distance from the point of melting; and if the snow is melted near the mouths of sewers it must be first scraped up and transported there. The expense too would be great; careful figuring shows that one pound of coal (costing in Paris 3½ cents) would melt only 18 pounds of snow, or at a cost of about one-fifth of a cent per pound.

The use of salt has very considerably reduced the municipal expenses of Paris, and has maintained the circulation of the enormous wheeled traffic of that city by reducing the trouble arising from a fall of snow to a minimum.

The Italian and Sicilian Tunnel.

The project for a tunnel between Italy and Sicily, proposed 7 years ago by the Engineer Gabelli, has taken a fresh start. The Italian government for a long time unfavorable now encourages this scheme somewhat, and Sicily is inclined to decidedly favor it. The Minister of Public Works has recently instructed engineer Carlo Navone to make a more complete study of the Gabelli plan and put it into definite shape. The tunnel would cost $14,000,000 and five years time; it would be eight miles long and descend 500 feet below the surface of the sea. The Sicilian gealogist, Seugneura is of the opinion that the formation underlying the Straights of Messina are favorable for tunneling; but others hold the contrary opinion and propose a bridge.

London Sewage Disposal.

The Metropolitan Board is giving further attention to what is known as the "Canvey island" scheme for the disposal of London sewage. But at the same time they continue the investigation of the precipitation and deodorising plans at Barking and Crossness, as proposed by Mr. W. J. Dibdin. If the chemical treatment fails something else must be done; and the expressed opinion of the Royal Commissioners is that this "something else" must really come to pass.

The Canvey island scheme assumes that all the sewage now discharged at Barking and Crossness shall be carried to Canvey island in a crude state by an extension of the conduits and by pumping. The estimate for treatment at the present outfalls into the Thames is $5,700,000, and this sum would be wasted if the sewage was finally taken further down the river. The disposal of 3000 tons of sludge is one of the difficult features in any chemical treatment plan. But Col. Jones, who suggests the Canvey island project, proposes to use this sludge in filling up the low island without pressing it, and thus avoid the expense of that portion of the treatment and the cost of transporting it to the sea. He would simply deposit the heavier material in earthen basins, possibly quickening the process and deodorizing by certain chemicals; the solids would remain in these cheaply constructed basins, while the effluent would flow into the sea. The available area is large enough for not only the London sewage but also that of the Lower Lea valley.

As estimated by the Board the cost of treating the sewage at the present outfalls, including interest on plant, depreciation, wear and tear, etc., would be $590,000 per annum. The annual cost of the scheme of Sir Joseph Bazalgette for conveying the sewage to Thames Haven and there discharging it into the river, including treatment, would be $1,075,000; the first cost of transporting the sewage to Thames Haven is estimated at $16,830,000. On the other hand Col. Jones and Bailey-Denton, estimate the cost of acquiring Canvey island at $1,150,000; other items would raise the cost to $1,335,500, and at 3 per cent. the annual charge would be about $40,000. The permanent work would cost $5,200,000, and the extension of the sewerage to Canvey island is estimated at $16,250,000. Working expenses are put at $100,000 per annum and pumping at $200,000. Altogether the annual expenditure would appear to be about $989,000. The scheme seems to have been planned with great care and is intended to remove for "all time" all the dry weather flow now discharged at Barking and Crossness and from all towns below Waltham in the Lea valley. The island is isolated and bare of immediate population; it lies directly at the mouth of the Thames on the northern bank, from twenty-five to thirty miles below the city of London.

PERSONAL.

JOHN C. TRAUTWINE, JR., thanks "Civil Engineer" for his kind suggestions and begs he will send his name and address to No. 3301 Haverford St. Philadelphia.

J. H. LINVILLE, Philadelphia, Pa., is Vice-President and Chief Engineer of the Washington & St. Mary R. R.

H. C. ROWEY, of Denver, Col., has arrived at Jackson, Tenn., to make the plans and specifications for the new sewerage system.

THOS. H. WIGGLESWORTH is Chief Engineer; and F. E. NELSON, Superintendent of Construction, of the Colorado Midland R. R. Their headquarters are at Colorado Springs, Col.

BENJAMIN F. LEDBETTER, Surveyor-General of Louisiana, died December 7th, in New Orleans, after a brief illness. He was a native of Alabama, a prosperous planter in north Louisiana, and was held in the highest esteem. During the war he was a captain in the Confederate army.

MR. DAWSIAR, C. E., New York City, is now making borings on the Arkansas shore, opposite Memphis, Tenn., for the foundation of the new bridge across the Mississippi at that point. The bridge is to be erected by the Nettleton syndicate controlling the Kansas City, Fort Scott & Gulf R. R., and the Kansas City, Springfield & Memphis R. R.

CHARLES SPROATT, City Engineer of Toronto, Canada, has been appointed Commissioner of Health and Works. This is the position over which there was so much agitation some time ago. The appointment is a complete vindication of MR. SPROATT'S character and a fitting compensation for the persecution to which he was subjected during the Garrison Creek Sewer trial case.

SECOND LIEUTENANT JOSEPH S. POWELL, of the Signal Service, has been detailed to duty at Omaha, to take charge of the organization of thirty meteorological stations of the Union Pacific R. R. in conjunction with the Weather Bureau of the Signal Service. It is said that when these systems are in working order will be impossible for a cold wave or any decided change of that kind to pass the Mississippi valley without immediate and timely warning.

MOVEMENTS OF U. S. ENGINEER OFFICERS.—Capt. Henry S. Taber will proceed to Kennett, Mo.: Capt. T. Rossell, to Wilson's Point, La., and Vicksburg Miss.; Cols. Thos. Lincoln Casey and H. L. Abbot and Lieut. Col. C. B. Comstock, to Little Rock and Fort Smith, Ark., on duty connected with the improvemen of the Arkansas river; Lieut. Col. John W. Barlow to Sloan's shoals of the South Fork of Cumberland river, Ky.: Lieut. Wm. M. Black, to Saint Augustine, Fla.; Lieut. Col. Wm. P. Craighill, to Richmond, Va.; Major Jared A. Smith, to Camden, Rockport and Bath, Me.; Capt., Daniel W. Lockwood, to Michigan City, Ind.; Major Oswald H. Ernst, to Clinton, Texas; Major Thomas H. Handbury, to Farm Creek, Ill.; Lieut. Edward Burr, to Portland, Oregon, on temporary duty. Lieut. Col. George H. Elliot and Lieut. Col. George L. Gillespie are detailed as a board in New York to examine engineer officers for promotion.

The statement made lately in our Personal column that COL. GEORGE H. MENDALL, United States Engineer, has been relieved from duty on the Pacific coast, is now denied as totally false. The mistake arose from the announcement of the appointment of Maj. W. H. H. Benyard, "as relieving COL. MENDALL," whereas he only relieves him so far as duty at San Diego harbor is concerned.

V. G. BOGUE has been appointed Chief Engineer of the Union Pacific R. R., and will take charge of the construction department this month. MR. BOGUE was Assistant Engineer of the Northern Pacific R. R. during its construction.

JAMES W. MCCULLOH, over whom there has been a protracted war in and out of the New Croton Aqueduct Commission, was, on December 8th, continued in the service of the Commission, as "special assistant to the chief engineer" at a salary of $5,000 per annum, to date from December 31st. He will be assigned to "the service, control and direction" of the Committee on Real Estate.

THE AQUEDUCT COMMISSION, on December 8th, reported in favor of appointing a board of experts, to consist of two or three members, to consider the practicability and necessity of the proposed Quaker Bridge dam.

ELLIOT C. CLARKE, long prominent in engineering circles in Massachusetts, has been appointed treasurer of the Boott Mills, of Lowell, Mass. We cannot say to what extent this appointment will interfere with his professional duties.

Engineers' Club of St. Louis.

The club held its annual meeting December 1, 1886, at Mercantile Library, President McMath in the Chair. Fifteen members and one visitor present.

The committee on nominations of officers for the coming year reported as follows: For President, Wm. B. Potter; Vice-President, Mr. L. Holman; Librarian, J. B. Johnson; Secretary, W. H. Bryan; Treasurer, Ed. Flad; Directors, R. E. McMath and Wm. Wise.

Chas. F. White addressed the club on the subject of furnace efficiency, giving the results of some tests at the Anheuser-Busch brewery on evaporation and smoke prevention. The subject was discussed by Messrs. Breden, Bryan, Monell, Johnson, Bruner, Moore and Holman. Adjourned.

WM. H. BRYAN, Secretary.

Seventh Annual Convention of the American Society of Mechanical Engineers.

WEDNESDAY, DEC. 1, 1886.

The day was devoted to an excursion by boat to the city of Newark. On the way down, a stop was made at he Statue of Liberty on Bedloe's island, and in Newark visits were paid toClark's Thread Mills, to Edward Weston's private laboratory, U. S. Ill. Co., to the factory of the Watts, Campbell Co., and to other works. A reception and collation were the attention of the Mayor and Common Council of Newark. The excursion was well attended, and was thoroughly enjoyable and profitable in every way. But the pressure on our columns does not at this time permit us to devote space to details of this class.

In the evening a session was held at the Academy of Medicine, New York City

Mr. Oberlin Smith read his paper on the "Intrinsic Value of Special Tools." This is a discussion of the inventory valuation of "special tools" in the machinery plant. Mr. Smith inclines to the view that a special tool should not be reckoned obsolete while in the full career of its usefulness, but that very careful watch should be kept for any indications of a lessening demand for the merchandise, which the tool is made to produce. The moment such indications appear, depreciations should commence, and should be made rapid enough to be surely on the safe side, and to bring the value of the tool down to nothing but what it is worth for old material, before said marketable demand has entirely ceased. Of course, it should be mentioned, in this connection, that Mr. Smith first points out, that in the very nature of things, "special tools" are always kept up to their original standard of working conditon in order that they may do their work properly. Mr. Smith also impartially considers such opposite views regarding valuation of special tools, as that they should be depreciated by a large percentage, every year, until their value stands *nil* upon the inventory, again that a special tool has no value at all until it has paid for itself in extra profits, etc.,

The discussion following the reading of Mr. Smith's paper clearly brought out the fact that each individual must according to his special business and its needs determine upon such inventory valuations as he sees fit and that no cast-iron rules, or even general directions can be followed.

The next paper that was read was the one by Mr. W. E. Partridge entitled "Capital's Need for High Priced Labor." This paper is written with the view of controverting the theory that "the less the price paid for labor, the less will the product cost." The author maintains that "the truth in this case happens to be at precisely the opposite pole," that "the correct theory is, that high-priced labor maks a cheap product." The essence of the argument advanced is, that superior skill commanding higher wages, enables the production of goods at a cheaper first cost, than where less skilled and lower-paid labor is employed. On the other hand fair wages are reported to conduce to the development of skill, respectability of employé, to lighten the manufacturer's "pauper" tax, etc., and accordingly make production cheaper. Illustrative examples are cited in support of this position.

As was to be expected, Mr. Partridge's views though interesting were scarcely regarded as a practical contribution to the solution of the labor problem. The discussion partook, however, rather more of a politico-economic than of an engineering nature, and though in part valuable, is scarcely pertinent to our columns

THURSDAY, DEC. 2, 1886.

Morning Session.

The interesting engineering lecture-room of the Stevens Institute of Technology, Hoboken, N. J., equipped with its valuable collection of models and historical scientific apparatus, must have proved somewhat of an inspiration to the membership of the society there assembled.

The first paper read was by Mr. Benjamin Baker, of England, honorary member of the society, on "The Working Stress of Iron and Steel," which we consider of such interest to our readers that we will reproduce it in full in next week's issue of our journal.

Prof. De Volsen Wood opened the discussion by pointing out that a bar is not necessarily made useless when strained beyond its elastic limit. He cited the experiments of Commander Beardsley upon an eye-bar or link, which when put under strain in a tensile testing machine began to stretch and give way at the smallest section, at which point rupture was evidently beginning to take place, when suddenly the bar, owing to some defect in the eye portion unexpectedly broke at the eye and the test had to be discontinued. The specimen of reduced section and with permanent set was removed from the testing machine, and the eye repaired. After twenty-four hours the specimen was again placed in the testing machine, and now broke under a much higher strain, not at the reduced section, but at a different portion of the bar. Prof. Wood exhibited the specimen under discussion and concluded that the twenty-four hours rest which the specimen had had, enabled the molecules at the reduced section to arrange themselves so that the bar possessed greater strength. Prof. Wood believed that a slight over-straining of iron beyond the elastic limit once, or even twice or three times, did not hurt the metal, but of course there was a limit to this action and in conclusion, he pointed out that formulated experience, in the shape of laws, should not be considered final but only serve as a guide in practice and as an incentive to further experimenting, including new conditions.

Mr. Kent drew a different conclusion from Mr. Baker's data, as tabulated, to the effect that he considered that Mr. Baker's experiments showed that for the successful sustenance of repeated strains within the elastic limit, medium hard steel was preferable to soft steel. Mr. Kent referred to an article published nine years ago by Capt. Metcalf in the *Metallurgical Review*, citing evidence bearing out the same conclusion. The only danger connected with hard steel Mr. Kent considered to be its liability, to its fracture in manufacture.

Mr. Henning highly commended Mr. Baker's experiments and maintained that his own experiments and experience had led him to the same conclusions reached by Mr. Baker. He believed Mr. Baker's work to be specially entitled to appreciation from the fact that it recognized the strength of the metal to be based, not on its resisting power to one heavy steady strain, but to oft repeated strain. This was the condition of strain to which metal was subjected when forming part of a structure. Mr Henning considered it wrong to criticize Mr. Baker's conclusions simply on the basis of the tabulated data presented, for these data form but a small part of Mr. Baker's experiments and special experience which led him to the conclusions stated.

Mr. Towne was of the opinion that the data presented by Mr. Baker in his paper did not form a sufficient basis for all the conclusions put forth. He also mentioned the fact that in the manufacture of links of chains it was a recognized advantage to first strain the links a little beyond the elastic limit, and then give them the final pitch.

The next paper was that of Mr. William Kent, on the subject "Is Water-Gas an Economical Fuel? The substance of this paper is the proof that water-gas is not as economical as Siemen's gas, when used as a fuel for steel-melting furnaces, the main comparative waste of heat in the case of water-gas being the carrying off of heat in the superheated steam in the chimney gases. This view Mr. Kent supports by theoretical considerations which he presents, and which indicate a loss of economy in the use of water gas as fuel, equal to at least 11 per cent. of the total fuel value of the carbon used, and this independent of any loss which may arise from imperfections of the producer or its method of operation. Such a loss, he states, is not met with in the Siemen's system, nor in the ordinary system of direct burning of the fuel upon a grate, except in so far as moisture in the shape of cold water may be present in the fuel used.

Mr. Taylor objected to Mr. Kent's method of analysis, but as was to be expected since it is absolutely correct Mr. Kent's view was endorsed by several of the members, especially by Mr. Trautwine who in his ten years experience as one of the engineers of the Continental Iron Works, was well entitled to speak with authority on the subject.

Mr. Schuhmann and Mr. Trautwine, both pointed out, and Mr. Kent admitted, that for small plants, water gas practically had advantages above Siemens gas.

Mr. Andrew C. Campbell then read his paper on "A New Conigraph." This paper describes, that is sets forth, the theory and gives the practical details of a new and ingenious device which by comparatively simple transposition of its elements delineates the several conic-sections, the ellipse, the parabola and the hyberbola.

Mr. Campbell showed the practical working of the instrument, which was highly commended by professors MacCord and Webb. Mr. Couch believed it would be a valuable aid in the laying out of elliptical gearing, and Messrs. Kent and Sangunetti thought tools constructed on its principle would have applicaton, respectively in glass polishing and glass cutting. Mr. Henning thought that it would prove useful for laying out parabolic arcs of railroads.

Topical Discussion, No. 28, "What is the Practical Value of the Sand-Blast Process for Sharpening Old and New Files," brought the inventor, Mr. Trump, on the floor. Mr. Trump maintained that resharpening old files by this system made the file better than when new, and new files were greatly improved at the outset by sharpening them by the sand-blast system. As an indication of the relative values of the files, he instanced experiments made at his works in which a new file under a given pressure and use had filed true 44 square feet of surface when it became useless; that after sharpening by the sand-blast process the worn file under the same uses had filed 66 square feet of surface before becoming useless, that a second resharpening enabled the file to do a service of 107 square feet of surface, and the third resharpening 31 square feet of surface.

Messrs. Towne and Taylor bore strong testimony to the practical value of the system based on their experience in their respective works, viz: a decided reduction in the file bills. The power required for full capacity was placed at about six horse-power, and the steam pressure at sixty to one hundred pounds per square inch.

At 1 P. M. the society adjourned to the residence of President Henry Morton, where a pleasant conversazione and a well-appointed menu were thoroughly appreciated.

At 2 P. M. the society inspected the various laboratories of the Stevens Institute, where students were at work. The Institute made a splendid showing in its exhibit, and in the demonstration of the high practice and scientific calibre of its instruction. The members of the society were as much gratified as surprised at the ability and advance displayed.

Afternoon Session.

At 3 P. M. the society again convened in the engineering lecture room, to listen to Mr. William Cowles' paper on "Fire Boats." This paper describes the *Seth Low*, of the Brooklyn Fire Department, the first floating fire-engine, self-propelling and of high power, ever built, and that in the year 1885. Also similar boats, since designed and built for the Cleveland & Chicago fire-services; details of an English fire-boat of recent construction are also presented.

These American fire-boats are capable of throwing streams 4 inches in diameter. Mr. Cowles warmly and correctly upholds the value of 2½ to 3½-inch streams in the extinguishing of fires, pointing out how such a stream will tear its way through walls, partitions, goods, etc., into the heart of a big fire and break it up so that the small streams can operate on it effectively, while by themselves, "little streams from ¾-inch to 1¾-inch, such as the ordinary single shore engine can throw, are almost useless at a large fire except to keep it from spreading; they are vaporized before they can penetrate, thus even adding to the fire."

The main features in the design of a high-power fire-boat are, of course, the boiler and pumps. The boiler must have all the capacity which can be got on a certain prescribed displacement, which, as Mr. Cowles puts it, means two, three and even four times the capacity of that in an ordinary tug of similar dimensions. The hull and motive machinery must be secondary matters, as in a dredge or floating elevator. But manœuvering power and speed, in the order mentioned, are also very important items. As descriptive

of the type of boat under discussion, we present the following particulars relating to one of the boats, the *Geyser*, extracted from the detailed tabular statement given by Mr. Cowles.

The boiler is of the "Scotch" type with four furnaces, horizontal steam drum athwartships; forced draught. The boiler shell, over all, is 11 feet 4½ inches diameter by 16 feet long. Furnaces, 36 inches diameter by 13 feet 10 inches long; grates, 7 feet long; working steam pressure, 100 pounds; grate surface, 84 square feet; heating surface, 3,091 square feet; weight complete, steam up, 44 tons.

There are two steam pumps, of the vertical duplex type, with cranks and fly-wheels, ordinary slide steam valves, rubber water-valves of special form, with extra large area and straight ports. The four water cylinders are 9 inches in diameter by 10 inches stroke; the four steam cylinders, 17 inches in diameter by 10 inches stroke.

The hull is constructed of wood: length over all, 105 feet; beam, over all, 24 feet 8¾ inches; length on low-water line, 95 feet 5 inches; beam, 21 feet 8 inches; depth moulded, 11 feet; extreme draught 8 feet 10 inches; displacement to low-water line, 201 tons; coal capacity in bunkers, 54,000 pounds.

The motive power consists of two simple, vertical, direct acting engines. Cylinders on wrought-iron columns. The diameter of the cylinders is 18 inches; stroke of pistons, 20 inches. The engines are provided with links, (no cut-off valves) with steam reverse gear, and exhaust to atmosphere or through heater and stack for blast.

The propeller has four removable blades, of cast-steel; diameter of propeller, 7 feet 10 inches; pitch 12 feet.

The paper was briefly discussed by Messrs. LeVan and Cole.

Mr. West next read his paper on "Casting Aluminium Bronze and Other Strong Metals." In this paper were pointed out the principles established and the methods used by the writer for the successful molding and casting of aluminium bronze in the foundry of the firm manufacturing this metal and other alloys of aluminium, at Lockport, N. Y. The main difficulties to overcome are the evils due to oxide, shrinkage and contraction. Illustrative cases were cited. The only way to ensure against the evils of shrinkage in aluminium bronze was to have the "risers" larger than the body or part of the casting which they were intended to "feed." The writer well says that "progress is made by which almost any kind of casting can be procured as readily as of cast-iron," and that "with aluminium bronze, 'Mitis' and steel castings to be had, the engineer should not want for strong metals to meet almost any conditions which he may desire."

The discussion on this paper in which Messrs. LeVan, Morgan, Sr., Dodge, Oberlin Smith and C. C. Hill were participants, related to practical questions of moulding, too detailed in character for presentation here. Mr. Dodge advocated the merits of malleable cast-iron as better than wrought-iron, and Mr. Oberlin Smith, on the other hand, considered steel castings better than those of malleable iron, and scored a point by adding that "they take about as long to get." Mr. LeVan considered that little advance in casting had been made in the last hundred years, from which point of view Mr. Morgan begged to differ, showing that the higher temperature and greater shrinkage of steel in casting made demands on the moulder which did not exist years ago. It appeared from the discussion that "blow-holes" were the great drawback to "Mitis" and other high-strength metal castings, which had still to be overcome. Mr. West thought the overcoming of these difficulties was simply a matter of ability and care on the part of the moulder.

Topical Discussion, No. 30, "Is Aluminium Bronze Corroded by Exposure to Weather?" was replied to in the negative by Messrs. West and Sanguinetti, who spoke from experience.

Topical Discussion, No. 29, "Which do you Prefer, a Feed-Pump or an Injector?" caused Mr. Wolff to say that this could be answered by one word, "Both," to which Mr. Babcock begged to add two more, "That depends."

Discussion by Messrs. Ker and Giddings, who had had occasion in their respective concerns to send out hundreds of plants, requiring the feeding of boilers, brought out the fact that no steam plant should be without both injector and feed-pump, though Mr. Giddings added that of late their practice was inclining to use two injectors. The poor quality of make of small feed-pumps in the market was also commented upon by both these gentleman.

Topical Discussion, No. 31. "What is the Best Way to Build Annealing Furnaces for Small Gray Iron Castings," called forth some interesting details by Mr. Dodge, showing that it was advantageous to have heat on top and the flues at bottom of furnace. Messrs. A. H. Emery, Henning and Towne gave experiences, in the main confirming this position.

Topical Discussion, No. 32, "What is the Best Way to Separate Grit from Grinding Rooms and Prevent its Dessemination in Yards and Shops," brought out much discussion and details of devices. Messrs. Dodge, Giddings, Partridge and Towne were the speakers. In all devices spoken of, the settling chamber was the important element.

Topical Discussion, No. 33, "How may Drawings be Made and the Expansion and Contraction of the Paper be Avoided," discussed by Messrs. Oberlin Smith, Webb, Partridge, Herman, Weightman, Babcock and Charles T. Porter, made it plain that contraction and expansion of paper could not be prevented, nor could the shrinkage, etc., of drawing-board. Proper lettering of dimensions of drawings was, therefore, deemed of importance. The merits of cross-section paper was also extolled.

In reply to Topical Discussion, No. 34, "How can Intricate Templets be Cut from a Very Thin Metal?" Messrs. Oberlin Smith and Sanguinetti pointed out the value of a jig-saw for this purpose. The latter said the thin metal should be glued to two pieces of thin board, between which it is placed, and the design pasted on top of board. This way the saw would leave no rough edge or bur on metal template.

With Mr. Wm. R. Jenkins explanation, "Why Twisting an I-shaped Oil Well Sucker-rod Prevents its Sockets from Unscrewing," the professional session was at an end.

Suitable resolutions of thanks were then offered, expressing thanks to the various gentlemen, corporations and institutions, who had entertained the society. These were quickly and heartily adopted.

FRIDAY, DEC. 3, 1886.

The day was devoted to a delightful excursion to Trenton, N. J., by a special train, furnished by the Pennsylvania railroad. Various points of interest were visited at Trenton, the main sojourn being the wire mill of Messrs. Cooper, Hewitt & Co., who entertained the society and provided the refreshments.

Taken all in all, the Seventh Annual Convention of the American Society of Mechanical Engineers must be declared to equal the best of its predecessors in all those features which render associations of engineers stimulating and of value.

We subjoin a list of the gentlemen registered as present at the Annual Convention:—

LIFE MEMBER: Thomas F. Rowland, Greenpoint, N.Y.

MEMBERS: Francis B. Allen, Hartford, Conn.; John F. Allen, New York City; Thomas R. Almond, Brooklyn, N. Y.; Daniel Ashworth; George H. Babcock, New York City; W. S. G. Baker, Baltimore, Md.; Stephen W. Baldwin, New York City; George A. Barnard, New York City; James C. Bayles, New York City; Arthur Beardsley, Swarthmore, Pa.; William Betts, Wilmington, Del.; Hugo Bilgram, Philadelphia, Pa.; Gorge M. Bond, Hartford, Conn.; J. V. V. Booraem, Brooklyn, N. Y.; James Brady, Brooklyn, N. Y.; John T. Burr, Brooklyn, N. Y.; Thomas Wells Capen, Stamford, Conn.; R. C. Carpenter, Lansing, Mich.; W. Lee Church, New York City; Charles L. Clarke, New York City; Samuel J. Clarke, New York City; J. Wendell Cole, Columbus, O.; Alfred Colin, New York City; C. C. Collins, Newark, N. J.; Augustus W. Colwell, New York City; Charles H. Corbett, Brooklyn, N. Y.; Alfred B. Couch, Philadelphia, Pa.; William Cowles, New York City; James A. Crouthers, New York City; George R. Cullingworth, New York City; David P. Davis, New York City; Isaac H. Davis, Dorchester, Mass.; James E. Denton, Hoboken, N. J.; Wm. H. Doane, Cincinnati, O.; James M. Dodge, Philadelphia, Pa.; A. Faber Du Faur, New York City; W. F. Durfee, Bridgeport, Conn.; Jarvis B. Edson, Brooklyn, N. Y.; Albert H. Emery, Stamford, Conn.; Matthias N. Forney, New York City; John Fritz, Bethlehem, Pa.; C. M. Giddings, Massillon, O.; John J. Grant, Fitchburg, Mass.; O. S. Harmon, Jersey City, N. J.; F. F. Hemenway, New York City; John Henney, Jr., New Haven, Conn.; Gustavus C. Henning, New York City; Ludwig Herman, Cleveland, O.; Wm. Hewitt, Trenton, N.J.; Milton P. Higgins, Worcester, Mass.; C. C. Hill, Chicago, Ill.; Gustav Hillmann, City island, Westchester county, N. Y.; A. C. Hobbs, Bridgeport, Conn.; Herman Hollerith, Washington, D. C.; Sumner Hollingsworth, Boston, Mass.; Robert W. Hunt, Troy, N. Y.; Frederic R. Hutton, *Secretary*, New York City; W. H. Inslee, Newark, N. J.; Albert H. Jacobi, Newark, N. J.; Wm. Kent, New York City; Charles Kirchhoff, New York City; Gaetano Lanza, Boston, Mass.; W. Barnet Le Van, Philadelphia; Pa.; Wilfred Lewis, Philadelphia, Pa.; Wm. C. Mackinney, Philadelphia, Pa.; Charles H. Manning, Manchester, N. H.; Ferdinand Martens, College Point, L. I.; Joseph Morgan, Jr., Johnstown, Pa.; Thomas R. Morgan, Sr., Alliance, O.; Henry Morton, Hoboken, N. J.; S. W. Murray, Milton, Pa.; Carleton W. Mason, New York City; Wm. H. Odell, Yonkers, N. Y.; Charles H. Parker, Cambridgeport, Mass.; Edward H. Parks, Providence, R. I.; Henry Parsons, Newark, N. J.; Wm. E. Partridge, New York City; Ferdinand Philips, Philadelphia, Pa.; Franklin Phillips and George H. Phillips, Newark, N. J.; Charles T. Porter, New York City; Holbrook F. J. Porter, New York City; Charles Potter, Jr.; Plainfield, N. J.; Charles W. Pusey, Wilmington, Del.; A. H. Raynal, New York; A. Wells Robinson, Montreal, Canada; Thos. F. Rowland, Jr., Brooklyn, N. Y.; Adolph W. Schleicher, Philadelphia, Pa.; George Schuhmann, Reading, Pa.; Horace See, Philadelphia, Pa.; George H. Smith, Providence, R. I.; Oberlin Smith, Bridgeton, N. J.; Henry I. Snell, Philadelphia, Pa.; Albert Spies, New York City; Albert Stearns, Brooklyn, N. Y.; Norman C. Stiles, Middletown, Conn.; Allan Stirling, New York City; Ambrose Swasey, Cleveland, O.; Harris Tabor, New York City; Edward P. Thompson, New York City; Robert H. Thurston, Ithaca, N. Y.; Henry R. Towne, Stamford, Conn.; Alfred P. Trautwein, Brooklyn, N. Y.; Wm. P. Trowbridge, New York City; Lyman A. Upson, Thompsonville, Conn.; Aaron Vanderbilt, New York City; W. E. Ward, Port Chester, N. Y.; B. H. Warren, Boston, Mass.; John Burkitt Webb, Hoboken, N. J.; Samuel S. Webber, New York City; William Oliver Webber, Lawrence, Mass.; George W. Weeks, Clinton, Mass.; Wm. H. Weightman, New York City; J. Leland Wells, New York City; Thomas D. West, Cleveland, O.; H. Herman Westinghouse, New York City; Edward Weston, Newark, N. J.; Frederic M. Wheeler, New York City; Joseph J. White, Philadelphia, Pa.; Moses G. Wilder, Philadelphia, Pa.; Wm. H. Wiley, New York City; Samuel T. Williams, Philadelphia, Pa.; Alfred R. Wolff, New York City; John Q. Wright, Fitchburg, Mass.; Robert R. Zell, New York City.

ASSOCIATES: Jackson Bailey, New York City; David W. Brown, New York City; Wm. Gibson, Jr., New York City; John H. Hall, Portland, Conn.; Gardner C. Hawkins, Boston, Mass.; Horace B. Miller, New York City; Lycurgus B. Moore, New York City; John A. Roche, Chicago, Ill.; Charles Sperry, Port Washington, L. I.

JUNIORS: Knight Neftel, New York City; Charles B. Rowland, Brooklyn, N. Y.; Edward N. Trump, Syracuse, N. Y.

Report of the Secretary of War.

The portion of the late report of Secretary Endicott, relating to the Engineering Bureau, contains the following items of general engineering interest:—

At the South Pass jetties the channel has been maintained as required by law; Mr. Eads has been paid $100,000 for the year ending September 26, 1886, and also $50,000 as one year's interest on the $1,000,000 still retained. The total expenditure to the date named was $5,300,000.

In connection with the works for increasing the water supply of Washington, D. C., the dam at Great Falls across the Potomac is nearly completed. The tunnel is now excavated for 18,538 feet, leaving 2,150 feet unfinished at the close of the fiscal year. Work on the reservoir is being continued.

The expenditures for the reclamation of the Potomac Flats, under the Act of Congress of August 2, 1882, has thus far amounted to $739,574. Larger appropriations are recommended, and the Secretary thinks that $700,000 could be profitably expended during the fiscal year ending June 30, 1888.

Secretary Endicott reports the bridge-pier now being erected in the Mississippi river, at St. Paul, by the Miss. & Northwestern R. R. Co. as an obstruction to navigation; but he at the same time acknowledges that until Congress acts in the matter, the power of the State over bridges, across navigable streams within its limits is plenary. And the railroad company is building under authority from the State of Minnesota.

NEW ROCK DRILL.—A hand-power rock drill, the invention of M. Daulresse, manager of the Carvin mines, is attracting some attention in France. The mechanism consists of a helical spring, which is compressed successively by three cams set on a shaft to be turned by means of two crank handles in the usual way. The sudden liberation of the spring drives the drill against the rock. The number of strokes a minute is from 160 to 170. The merit of this machine lies in the extreme simplicity of its construction. Of novelty, it has but little. The trials which have been made at Carvin in a heading 6 feet 6 inches in height by 5 feet broad gave in hard sandstone a cost of 66 francs and in hard shale a cost of 32 francs against 100 francs and 45 francs respectively when the boring was done by ordinary hand-drilling. In the sandstone the rate of advance was one yard a day with one machine worked by three shifts of three men each.

WATER.

BRAIDWOOD, ILL.—The fire protection scheme has been completed. It consists of a No. 5 Goulds rotary pump with a belt and pulley from an engine of certainly not more than 10 horse-power. At the test recently made two good streams of 75 feet through ⅞-inch nozzles from a hydrant 3,100 feet from the pump were thrown. The hose used was 2½ inches; main pipe 6 inches, with 6-inch suction 200 *feet long and a lift of* 16 *feet*. No foot valve on pumps, but the suction was caught in less than one minute. The Mayor of Braidwood in a letter to the manufacturers says: "The works are completed and the pump gives the very best of satisfaction."

The entire system was supplied by Messrs. Goulds and Austin, of Chicago, Ills., the Western house of the Goulds Manufacturing Co., of Seneca Falls, N. Y., who make these rotary pumps with especial adaptation for fire protection service and supplying all street mains and hydrants. The firm are now at work upon a new piston pump designed for same purposes. It will be 8-inch bore, and 12-inch stroke, driven by tight and loose pulleys with gear connections.

HOULTON, ME.—A sewerage system is proposed; the matter will be introduced into the next legislature.

INDEPENDENCE, MO.—The water-works have been purchased by the Winner Investment Co., of Kansas City, Mo., for $7,000.

THE Detroit Pipe Foundry Co.'s works at Detroit, Mich., were burnt to the ground this week; machinery and patterns to the value of several thousand dollars was destroyed. The loss is estimated at $100,000.

INDIANAPOLIS, IND.—The City Council has contracted with the water company for three years; $45 per annum will be paid for each hydrant. The company will lay 3,000 feet of mains each year, with one hydrant to each 500 feet of mains.

NATURAL GAS FOR BUFFALO.—The gas was turned on by the Natural Gas Co. last week for the purpose of blowing through and testing the pipe; it was ignited at a branch stand-pipe and the flame extended 80 feet. The main is 8 inches in diameter.

GOOD WORK.—During the last three months James Frisby, foreman of the Oswego (N. Y.) water-works, ran and drove 2,265 joints of pipe, from 4 to 12 inches in diameter, but principally of the larger size; under test only three leaks were shown. This record, he thinks, is hard to beat.

BAINBRIDGE, GA.—The town has two artesian wells, 900 and 1,200 feet deep, cased to the bottom, supplying an ample water supply of two different qualities; the cost of the wells and appliances up to date, including the operation expenses since completion, has been about $11,000. An iron tank with a capacity of 50,000 gallons gives the pressure, and there is a large amount of iron mains on hand.

PUMPING ENGINES.—The Cleveland, O., Board of Water-Works Trustees has awarded the contract for the new pumping engines to the Knowles Steam Pump Works, New York City. They are to be compound, condensing, duplex engines; diameter of high-pressure cylinders, 37 inches, of low-pressure cylinders, 70 inches; pump plungers, 37 inches in diameter with stroke of 4 feet. They are each to pump 15,000,000 gallons of water per day, against a head of 230 feet, with a boiler pressure not exceeding 70 pounds per square inch. The contract price was $70,000.

PHILADELPHIA, PA.—Mr. Howard Murphy, engineer to the Committee on Water Supply of the Public Building Commission, has made his report. He recommended laying the 12-inch main to supply the City Hall under the footway of the Market street bridge, which will be completed next year. The committee has decided that the main shall be of cast-iron, 550 feet long, with five expansion joints. A 3-inch layer of non-conducting material will be laid round the main and covered with an iron casing. The estimated cost is $6,500.

THE PULSOMETER IN DEMAND.—The Pulsometer Steam Pump Co., 83 John street, New York, is this week in receipt of an order from the Japanese Government for new pulsometers to the amount of $5,700, the result of trial of pumps previously sold the same party. The same company has an inquiry from a western city for a pumping plant of 15,000,000 gallons per twenty-four hours. They have just shipped the ninth pump to the Atchison, Topeka & Santa Fé R. R. Co., and have shipped several and have further inquiries for new pulsometers for irrigation purposes in southern California.

OSWEGO, N. Y.—The Oswego Water-Works Co. has completed extensive improvements to the works. Several miles of new mains have been laid during the fall and the necessary connections made with existing mains to give an increased supply and uniform distribution and pressure; the extensions include an auxiliary 12-inch main from the high dam reservoir and the connection of numerous dead-ends. The result of the work is highly satisfactory and places the system in much better condition for fire protection and general purposes.

CORTLAND, N. Y.—The water-works company's proposition will probably be accepted. It is to unlock the hydrants and furnish the water as last year until April and will take the chances of the people's vetoing the appropriation if the Village Board will pass a resolution recommending the payment for the forty hydrants for the entire year, except while they were locked, and also recommend the renting of the same for another year. There was some misunderstanding about the appropriation asked for last spring by the trustees, and this was the cause of its being voted down. The trustees asked for $450 more than the previous year, for which the water-works company was to extend its mains and put in nine new hydrants. This a great many thought to be an increase in price for the same number of hydrants and voted against the appropriation.

A COMPREHENSIVE SYSTEM.—Gen. P. N. Guthrie, George W. Lewis, Robert J. Hardy, W. R. Wilson and Robert Moore, of Pittsburg, Pa., are interested in a corporation to supply water to a number of towns along Chartiers creek. The scheme includes Mansfield, Chartiers, and the townships of Scott, Robinson, Collier, Chartiers and Stowe; they are full of mining towns, and can be connected without much trouble. As soon as the charter is granted work will be commenced.

WATER-WORKS IN VILLAGES.—Commenting on the burning of South Royalton and Townsend, Vt., neither of which places had any means of fire protection, the *American Machinist* pertinently says:—"There are many large villages in the country that could profit by experiences of this kind. The building of water-works is delayed long after the necessity, because the cost is looked upon as burdensome. Often water-works would, indirectly, be a source of revenue, to say nothing of their value in the instance of an extensive fire. A liberal supply of good water is looked after by manufacturers, and is a strong incentive to their location. In the establishment of water-works, it is not always wise to look too long after a source of supply by gravity, and to go too far to get water in this way. Sometimes the cost materially overbalances the saving. Pumping machinery has been so simplified and cheapened that it is often cheaper and more satisfactory to pump from near at hand than to bring from a long distance by gravity. This is especially true where the quantity of water required is not large, since the cost of a plant for a small supply is almost nominal."

NEW WATER-WORKS.—Aiken, S. C. A committee has been appointed by the mayor to investigate the question of a water supply; artesian wells are proposed.—Ware, Mass. The reservoir and pump are completed and water will soon be turned on; the reservoir has a capacity of 1,500,000 gallons and is lined with concrete, which is covered with broken stone. The cost was $13,500.—Huntsville, Ala. The city will build a new reservoir, purchase a new pumping engine and lay 1,000 feet of 12-inch pipe, 1,000 feet of 8-inch, and 6,000 feet of 6-inch. E. J. Mastin, Mayor.—Bridgewater, Mass. The town will probably build water-works; address V. R. Swift, moderator.—Elgin, Ill.—Spartanburg, S. C.—Griffin, Ga.—Spring Valley, Ill.—Raleigh, N. C.—Waterville Me.—Fairbury, Ill.—Charles City, Ia.—Rock Springs, Neb. The new works will be built by A. L. Strong & Co., of Omaha.—Abilene, Kan. New works are being built by H. H. Bonebroke.—Loveland, Col. The vote for water-works was carried by 98 for to 6 against.—East St. Louis, Ill. The new works were tested December 4th with satisfactory results.

SMITH'S FALLS, ONT.—The laying of water pipes by the C. P. R. R. will, we hope, be but a commencement of a system of water-works in Smith's Falls. As long as the water is drawn from the Rideau river in the vicinity of the town it will need to be filtered before being used for drinking purposes. But for fire protection, for washing and bathing and for use in gardens it is as good as any water could be, and, as we have said, if properly filtered will be good for drinking. We believe Captain Forster has arranged already, as far as Mill street and part of Russel is concerned, to provide all houses opposite the pipes with water. In addition to this we sincerely hope that hydrants will be arranged for at the head of Beckwith street and on Mill, and elsewhere if possible. They would greatly improve the fire protection, especially in a situation like that which we have been in lately with our fire engine undergoing repair and rendered useless for a time. If possible also, a branch might be run towards those points where the town is being rapidly extended, so as to get over the necessity for a new tank. These things can only be done by arrangement with the railroad company, but that arrangement could be made we have no doubt; they have already agreed to a change in the pipes to permit a private water supply, and they would doubtless agree to anything else in reason.—Smith's Falls, Ont., *Independent*.

BOSTON'S WATER SUPPLY.—The water boards of Boston, Chelsea, Everett and Somerville, have recently visited the Shawshine river and there is talk of making it an additional source of supply to the Mystic river.

THE Dean Bros. Steam Pump Works, Indianapolis, Ind., state that their business for this year has been double that of any previous year. They are now adding a number of machines designed specially for the manufacture of steam pumps, which will enable them to add to their force of workmen and increase their output to a considerable extent.

ROME, GA.—The water-works were built in 1871, by Noble Bros. & Co., then of the city, for $100,000. Major C. H. Smith was chairman of the water-works committee. The water, with a temperature of 59°, is pumped from a well, that was blasted through the rock, to a tank on a hill in the center of the city; the tank is 60 feet high, 25 feet in diameter and has a capacity of 220,000 gallons. The pressure in the mains in the business part of the city is 86 pounds and the average pressure over the whole system is 77 pounds.

NASHVILLE, TENN.—City Engineer Jowett has issued his report for the year ending October, 1886. There were laid 10,691 square yards of brick sidewalk, 10,311.7 feet of curbing, 13,158.8 square yards of guttering, 3,813 feet of crossing, 1,781.4 feet of box culverts, 1,389.87 square yards of concrete bitumen, 98,211 cubic yards of grading. Total cost $153,586.19. Of sewers, 12,949 feet were constructed, at a cost of $29,029.14. In the water-works improvement the total cost for masonry, concrete and material was $79,821.22; and the total cost for bridge improvement and approaches was $82,103.48. The total for all other matters was $344,040.03.

DETECTING WATER LEAKAGE.—The microphone is now being used in Germany for the purpose of detecting loss of water through leakage in town mains. The apparatus consists of a steel rod, which is placed upon the cock in the neighborhood of which the leak is suspected, and a microphone attached to the upper end of the rod. A dry battery and a telephone complete the equipment. No sound is heard in the telephone if the cocks are closed and no leak occurs; but a leak of even a few drops through a badly fitting cock causes sufficient vibration in the pipe to affect the microphone and to give audible sound in the telephone. At the recent meeting of gas and water engineers in Eisenach, it was stated that the apparatus is so simple to handle that, with a little practice, ordinary workmen are able to detect and locate any leak.

THE WATER SUPPLY OF IQUIQUE, CHILI.—The city stands on a sandy plain, near the seashore, the soil of which is rich, but as rain never falls there it cannot be cultivated. The population is 16,000 and 56,000 gallons of distilled sea water are used daily; three times a week a specially constructed steamer brings about 175,000 gallons of water from Arica, 110 miles up the coast; the greater part of this water is used by a railroad company. The distilled sea water is distributed through the city by water carts. Lately the city has laid 6-inch pipes from the shore to a tank of 11,800 gallons capacity situated on an elevation, from which a system of mains with fire hydrants extends through the streets and affords fire protection. Two powerful pumps, manufactured at the Knowles Steam Pump Works, of New York and Boston, force the filtered sea water to the tank, and in case of fire an engine can throw a 1¼-inch stream to a height of 60 feet. Over 300,000 gallons daily of good spring water can be obtained at Pica, at the foot of the Andes, 75 miles from Iquique, and the government has granted a concession to a Mr. Hart, an Englishman, to pipe this supply to the city; this concession he has sold to an English company, and now offers to contract with it to complete the works within eighteen months for $1,250,000. The scheme will probably be carried out shortly and a system of irrigation will probably be made an adjunct of the water supply system.

LAND RECLAMATION.—A project is on foot looking to the reclamation of about 8,000 acres of land at Copley swamp, near Akron, O. Having its rise in Copley swamp is a rivulet called Pigeon run. After flowing for about three miles it empties into Wolf creek, and five miles further on, at what is known as Wolf Creek lock, the latter stream empties into the Ohio canal. The canal is so high at this point that there is very little current in Wolf creek, and indeed the water backs up into Wolf creek, even as far back as Pigeon run. The result is that none of the 8,000 acres now water-soaked can be ditched because the water has nowhere to run. There are three ways of remedying the evil. One is to abandon the canal, this will probably not be done for some years to come. Another involves building a siphon to conduct the waters of Wolf creek, which are not needed to feed the canal, under the canal and off into the Tuscarawas river near by. This will give plenty of fall in Wolf creek and Pigeon run, and could

be accomplished for $6,000 or $8,000. The third plan is to move the Wolf creek lock, which is now above the mouth of Wolf Creek and put it below Wolf creek's mouth, thus bringing a high level opposite the creek and permiting of the construction of a culvert under it to convey away the water of Wolf creek. This scheme would cost about $30,000. The siphon plan is objectionable beceuse the siphon would be continually stopping up. The culvert and the change of the lock is the more feasible, even though more expensive way. The question is, how shall the expense be borne. The land owners are anxious to have the county and State act, and the probability is that something will be done before many months.

CHICAGO WATER SUPPLY.—Engineer Hering, of the Drainage and Water Supply Commission, is of the opinion that in the great problem of an increased and improved water supply for Chicago additional pumping stations will be an absolute necessity in the near future. He is quite convinced that the present North Side pumping works are taxed beyond their capacity, and that the excessive friction now necessary impairs the usefulness of the works. He states that it will be impossible for the commission to present a perfect and comprehensive plan for improving the water supply or providing for the carrying off of the city sewage by the end of the present year, as originally expected. He will however, have succeeded in demonstrating the need of certain marked and expensive improvements which will render necessary very important legislation at the next session of the General Assembly, which will enable the city to provide the funds necessary for whatever work is hereafter decided upon.

The work of tunneling under the lake for the north shore inlet has progressed within about 350 feet of the terminus, which will reach about 1,500 feet into the lake. The remainder of the work will be completed within a short time, when the connection will be made between the seven-foot crib tunnel and the new wing of the North Side pumping-works, which will increase the capacity of these works about 25,000,000 gallons daily. The tunnel is seven feet in diameter, and when completed and the new crib constructed the city will never be at a loss for an adequate water supply. A shaft will be sunk in the lake on the line of the new tunnel, which will be provided with gates, and no water will be drawn from this new tunnel unless the old submarine aqueducts give out. A lighthouse sixty feet high, to be illuminated with electricity, will be erected on the new crib. The recent gale on the lake which swept away all the machinery, derricks, and portable furniture from the crib, and the absence of the contractor, Gen. Fitz-Simons, materially delayed the work.

NEWS OF THE WEEK.

Contracting.

Street Improvements.—At Sea Isle City, N. J., $12,000 will be spent on street improvements before next season.

Water Pipe.—At St. Louis, Mo., the Board of Public Improvements has recommended an ordinance for extending the water distributing system by several hundred feet of iron mains.

Dredging and Dock.—The Delaware, Lackawanna & Western R. R. Co. has awarded the contract for a dock near Buffalo, to Daniel E. Bailey, Buffalo, N. Y.; and for dredging the channel to a depth of 18 feet to Messrs. Hingston & Woods.

Railroad.—The contract for the construction of the Zanesville, Mount Vernon & Marion R. R., from Zanesville, O., to Marion, 140 miles, has been awarded to E. J. Brooks, New York City. The road is to be completed within a year.

Messrs. Brown, Howard & Co., the contractors for the Duluth, South Shore & Atlantic R. R. have sublet the contract for clearing, grading, ties and bridging on the south branch from Sage, on the Marquette & Mackinac line, to Sault Ste. Marie, 46 miles, to Rexford Bros. & Hodge, New York City. The subcontracts for the western division will not be let for two or three months, as the location is not yet completed.

The contractor for the grading and ballasting of the Central Massachusetts R. R., from Jeffersonville to Ware, 26 miles, is J. K. Ryan; the Boston & Lowell R. R. Co. is laying the track. The grading and ballasting of the line from Ware to Belchertown has been sublet to Mulhall & Hawks; Ryan & Sullivan, and Hugh McIntyre, three miles each. All these contractors are New York parties.

Tests of Indurated Fibre.— "Indurated fibre," made of spruce, was tested last week in the testing department of Fairbanks & Co., of New York City. Three samples showed a maximum tensile strength of 11.513 14.659 and 16.422 pounds per square inch respectively.

Cross Ties.—The contract for 225,000 oak ties for the Texas & Pacific R. R. has been awarded to Messrs. Whitaker Bros., Texarkana, Ark.

Brick Paving.—The following proposals have been received at Quincy, Ill., for brick paving for streets: Caspar Rees, Galesburg brick, $1.82½ per yard. Charles Onrocker, Bardolph and Quincy brick (large size), $1.77; (small size) $1.82; Bardolph brick, $1.87; Galesburg brick, $1.92. The contract was awarded to Caspar Rees. Engineer, E. R. Chatten.

Hudson River Tunnel.—It is rumored that work is to be recommenced on the Hudson river tunnel at an early date. The rumor can be traced to no definite source.

Dredging.—The following bids have been received by Col. G. H. Mendell, U. S. Engineers, for dredging in Wilmington harbor: A. W. Von Schmidt, 29.8 cents per cubic yard; Pacific Coast Dredging & Reclamation Co., 50 cents; Henry H. Lynch, 57.2 cents.

Dredging.—The following proprosals for dredging in York harbor, Me., were opened by Major Jared A. Smith, U. S. Engineer Office, Portland, Me., on December 4th: Thomas Symonds, Leominster, Mass., 65 and 35 cents per cubic yard in place; Moore & Wright, Portland, Me., 67 cents; Hamilton & Sawyer, Chebeague, Me., 79.5 cents. The contract was awarded to Thomas Symonds.

Bridges.—The contract for the new iron bridge at Augusta, Ia., has been let to J. B. Diver & Co., Keokuk Iowa.

The contract for two iron bridges on the Brattleboro & Whitehall R. R. has been let to the Vermont Construction Co., St. Albans, Vt.

The contract for the bridges on the Massachusetts Central R. R., 43 in number, has been let to P. F. Finnigan, New York City.

Bridge and Improvement Bonds.—The following bids have been received at Detroit, Mich., for $100,000 Belle Isle improvement bonds and $270,000 bridge bonds: Stephen Rathbun, Boston, Mass., ½ and ⅞ of one per cent. premium respectively; Preston Bank, Detroit, ⅞ of one per cent. for the entire issue; Commercial National Bank, Detroit, ⅞ of one per cent, for the entire issue; People's Savings Bank, Detroit, ¼ of one per cent. for the entire issue.

Dredging.—The following were the proposals for dredging in the Saginaw river: Carkin, Stickney & Crane, East Saginaw, Mich., above Bay City, 34 cents per cubic yard, in scow; at bar, 44.5 cents. Hichler & Green, Sault Ste. Marie; at bar, 44.5 cents. Buck & Hubbell, Saginaw; above Bay City, 40 cents; at bar, 52 cents. L. P. & J. A. Smith, Cleveland, O., 60 and 50 cents. Stang & Gillmore, Lorain, O., 61 and 51 cents. George Talbot, Buffalo, N. Y., 60 and 50 cents. James Rooney, Toledo, O., 44.5 and 61.5 cents. The contract for dredging at the bar was awarded to Carkin, Stickney & Crane and Hichler & Green; for dredging above Bay City to the former firm.

Timber.—The following proposals for timber for repairing the Carrollton revetment and beam wall in the Saginaw river, have been received by Lieut. Col. O. M. Poe, U. S. Engineer Office, Detroit, Mich.: John G. Owen, East Saginaw, Mich., white pine timber, $19.25 per 1,000 feet B. M.; white pine plank, $12.75; hemlock plank, $9.25; mill edgings, $2 per cord; total $6,172.81. Carkin, Stickney & Crane, East Saginaw, Mich., $20, $15, $12, $12, $6,472.40.

Dredging.—The following proposals for dredging have been received by Capt. W. H. Bixby, U. S. Engineer Office, Wilmington, N. C.: Charles H. Lewis, Baltimore, Md.; New river, N. C., 38 cents per cubic yard; Bogue sound, 35 cents, Clubfoot and Harlowe creeks, 25 cents; 5 cents per cubic yard will be deducted from these prices if all three contracts are awarded. Rittenhouse Moore, Mobile, Ala., 28.5 cents (23.75 cents if the other two contracts are awarded); 32.5 cents (27.75 cents); 33 cents (27 cents if the other two contracts are awarded). R. P. Bowdoin, Wilmington, N. C., 29 cents, 33 cents, 38 cents.

Pumping Engines.—The following proposals have been received by the Trustees of the Water Works Franklin, O., for two compound, non-condensing, duplex pumps with a daily capacity of 750,000 gallons each, two steel boilers, two feed pumps, feed water heater, boiler settings, smokestack and all pipes and fittings complete: Holly Manufacturing Co., Lockport, N. Y.; $6,200, with Otis steel boilers. Smith & Vaile Co., Dayton, O.; $6,330 with Park Bros. steel boilers; $6,455 with Otis steel boilers. Gordon & Maxwell Co., Hamilton, O.; $6,500, steel not named. National Iron & Brass Works, Dubuque, Ia.; $7,500, Otis, Park Bros, or Cleveland Rolling Mill Co. steel, at the option of the Trustees. George C. Morgan, Chicago, Ill.; $8,546, steel not named.

Dredging.—The following bids for rock excavation and dredging in Ashtabula harbor, were opened by Major S. Cooper Overman, U. S. Engineer Office, Cleveland, O.: Carkin, Stickney & Crane, East Saginaw, Mich.; solid rock from channel, $2 per cubic yard, from bar, $2.44; loose rock, $2; stone and gravel, $2; sand and mud, 90 cents; total $18,300. L. P. & J. A. Smith, $3.95, $5; 35 cents, 35 cents, 35 cents; total, $28,895. Stang & Gillmore, Lorain, O., $3.90, $4.90, $2,44, 60 cents, 60 cents, total $30,950. The contract was awarded to Messrs. Carkin, Stickney & Crane.

Levee Work.—The following bids have been received by the Louisiana Board of State Engineers:—(1) Levee from Arkansas City to Amos bayou, Ark.; George Arnold & Co., 26.5 cents per cubic yard; J. J. Cooney, 28 cents; Tennessee Industrial Co., 22 cents; T. & H. Duffin, 27 cents; all of Memphis, Tenn.—(2) Levee from Arkansas City to Eunice Landing and from Eunice Landing to Panther Forest, Thomas O'Malley, 29 cents, for the first section only; Thomas F. Duffin, Memphis, Tenn., 26 cents, for the entire work. Contract awarded to T. F. Duffin.—Lefebre levee; eight bids were received; the lowest were M. B. McGarry, 18.49 cents and P. Harman, 19¾ cents.

Dredging Suit.—The City Council of Wilmington Del., is having a legal contest with the National Dredging Co. This company entered into a contract to extend certain streets for $12,500; $9,000 of this is paid, but the street can not be finished owing to the ebb and flow of the tide. The company claims that it has actually expended $3,346.14 on the work for which payment is due; the city claims that the contract is incomplete and offers $1,800 in full payment. No decision has been announced as yet.

City Work.—At Wilmington, Del., the following bids for 2,033 cubic yards of grading have been received: Walter McEviley, 27 cents per cubic yard; P. Carbery, 25 cents; Michael Riley, 16.75 cents.—Alvin R. Morrison has been awarded the contract for work at the new bridge across the Brandywine river, at Market street, at the following prices; masonry, $15.46 per cubic yard; filling, 38 cents per square yard; Belgian block paving, $2.09 per square yard; cobble-stone paving, 76 cents; brick paving, 80 cents; curbing, 90 cents per lineal foot. The other bidders were, Davis & Bro., Wilmington; John Gordon, Chester, Pa., and Albert G. Barker. A. R Morrison was also awarded the sub-contract by the Jersey Iron & Steel Co. for the woodwork and flooring for the bridge.

Surveys.—The final survey of the extension of the Memphis & Charleston R. R. from Stevenson, Ala., to Chattanooga, has been commenced.—A survey is being made for the East End Passenger R. R. from Pittsburg, Pa., to Braddock, 10 miles.—Surveys are being made for the Jacksonville, Atlantic & Gulf R. R.; Col. Carter, Jacksonville, Fla., is interested.—The survey of the Louisiana & Alabama R. R. from Donaldsonville to Thibodeaux, La., has been started at Napoleonville; Capt. M. W. Darton and J. H. Musley have charge of surveys and construction.—Surveys have been made for the extension of the Bloomfield branch of the Delaware, Lackawanna & Western R. R. to Morristown, N. J.—The engineers of the Colorado Midland R. R. are surveying a line from Pueblo, Col., to Salt Lake City, U. T.—The location of the Louisville, St. Louis & Texas R. R. has been commenced at Louisville, Ky.; it will run from Louisville to Henderson, 136 miles.—A survey has been started for the Omaha & Kansas City R. R. from Fairfield, Neb., towards Denver, Col.; construction will be commenced in the spring.—A survey from Van Buren, Ark., to Winfield, Kan., is being made for the Arkansas Valley R. R.—Surveys have been made as far as Dunlap, Tenn., 27½ miles, for the extension of the Jasper branch of the Nashville, Chattanooga & St. Louis R. R.; the location of the Elora branch, 26½ miles, will be completed and work commenced this month.—A survey for the Sioux City & Wilmar R. R. has been started on the line of the old survey from Wilmar, Minn., to Spirit Lake.

Mississippi River Improvement.—The Mississippi River Commission, at St. Louis, Mo., has made an allotment of $100,000 for the construction of levees, the money to be used on the Tensas basin line and on the Tensas front. This makes in all $500,000, or one-fourth of the entire appropriation of $2,000,000. The protection of the Tensas basin is to be secured by building levees in Arkansas to prevent, first, the waters of the river from escaping through Bartholomew bayou and Opossum fork, two outlets which connect the Arkansas above Arkansas City, with the Ouachita river, and, second, to prevent the waters of the Mississippi from coming through breaks in the Arkansas State levees in the Chicot and Desha counties, and thence escaping into Boggy bayou and by other routes into the Tensas river in Louisiana. Heretofore, for want of sufficient levees over a distance of some sixty miles from the Arkansas river down to the Louisiana State line, a vast portion of northeast Louisiana is annually deluged with flood water. By the co-operation of the people of Chicot and Desha counties in Arkansas and the Mississippi River Commission combined with the Commissioners of the Tensas Basin Levee District, the Arkansas levees are to be rebuilt. The fund available

River Improvement.—The following proposals have been received by the City Engineer, Toronto, Ont., Canada, for improving the river Don:

Names of Bidders.	Section 1.	Section 2.						Section 3.					
	Dredging channel; complete.	Dredging and disposal. Per cu. yd.	Earth excavation and disposal. Per cu. yd.	Piling, wales, stay bolts, etc. Per lin. ft.	Piling, wales, elm ties, etc. Per lin. ft.	Timber. Per 1,000 feet B. M.	Ironwork. Per pound.	Dredging and disposal. Per. cu. yd.	Earth excavation and disposal. Per cu. yd.	Piling, wales, stay bolts, etc. Per lin. ft.	Piling, wales, elm ties, etc. Per lin. ft.	Timber. Per 1,000 feet B. M.	Ironwork. Per pound.
	$	Cents.	Cents.	$	$	$	Cts.	Cents.	Cents.	$	$	$	Cts.
Carkin, Stickney & Crane; East Saginaw, Mich.	129,000.00	—	—	—	—	—	—	—	—	—	—	—	—
Owen Sound Dredging Co.; Owen Sound, Ont.	8,500 00	—	—	—	—	—	—	—	—	—	—	—	—
R. McLennan; Toronto	—	23	22	12.05	12.08	18	3	26	22	12.05	12.08	20	3
Wm. Robinson; Owen Sound, Ont.	111,455.00	21	19	7.10	7.00	19	3	19	18	5.10	5.10	17	3
Doyle & Ryan; Toronto	—	27	23	9.50	9.75	22	5	27	25	9.50	9.75	22	5
Avary & Nicholson, Ottawa	103,494.50	—	—	—	—	—	—	—	—	—	—	—	—
Manning & Macdonald; Toronto	84,918.56	18	23	7.00	7.50	25	10	18	23	6.00	6.50	25	10
John Sullivan; Welland	206,988.99	—	—	—	—	—	—	37	37	14.50	15.00	60	12
Booth, Cosgrove & Gibson; Brockville	80,211.15	17	21	9.50	9.00	25	6	17	19¾	9.50	9.00	25	6
P. McRae; Toronto	—	30	26	12.00	12.00	38	4	30	26	12.00	12.00	38	4
Shields & Carroll; Toronto	66,342.62	14	20	12.56	12.21	30	6	16	20	12.56	12.21	30	6
McNamee & Talbot; Montreal	201,681.58	—	—	—	—	—	—	—	—	—	—	—	—
A. W. Godson; Toronto	—	18	24	8.07	8.74	21	4	22	22	8.07	8.80	21	4
A. Myers; Toronto	—	19¾	24	8.55	9.25	22	4	24	23	8.55	9.25	22	4
R. Weddell; Trenton	130,000.00	25	30	8.75	8.75	40	5	28	30	8.75	8.75	40	5
Pollock, Medlar & Arnott; Toronto	—	40	50	8.25	9.10	25	5	40	50	8.25	9.10	25	5
Reed and Hingston; Lachine, Que.	159,000.00	29	35	15.15	15.45	—	—	29	35	15.15	15.45	—	—
Chillim Jones; Prescott	79,500.00	—	—	—	—	—	—	—	—	—	—	—	—
Murray & Clendenan; St. Catherine's	110,455.61	27	28	13.33	13.33	30	5	27	28	13.33	13.33	35	5

Bids for truss and combination bridges on Section No. 2 varied from $12 to $75 per lineal foot.
Contracts were awarded as follows: Section No. 2, Manning & Macdonald, $118,223.98; Section No. 3, W. Robinson, $89,177.40; Bridges, A. Myers, at $13 per lineal foot for queen truss, $29 per lineal foot for combination bridges, and $980 for removing and rebuilding bridges; Section No. 1 has been abandoned for the present.

so far is as follows: Allotment by the River Commission—for Opossum fork levee, $35,000; Tensas Basin front, first award, $95,000; Tensas Basin front, second award, $100,000; total from River Commission, $230,000; from Chicot and Desha counties, $20,000; from Tensas Levee Board, $75,000; total, $325,000. In addition to the above the River Commission has allotted $270,000 more for the levees in Louisiana and Mississippi, of which $40,000 was for Morganza.

Steel Ties.—Mr. Phillips, late consulting engineer for the Queensland government, has patented a new form of steel tie, which is said to be especially adapted to the construction of railroads over soft level country. They are laid without ballast, and at small cost in a very short time; it is 6 inches deep and is partially embedded in the soil. The Queensland government has taken up the idea, and in a discussion in the Legislature at Brisbane, the premier stated that he expected to diminish the cost of construction of the railroad from Normanton to Cloncurry, and to considerably reduce the time required for its completion.

A South Australian Industry.—Mr. John Bennett' of the Globe Ironworks, Port Adelaide, has recently put in the most improved and expensive plant for the manufacture of splice-bars, bolts, spikes, etc., for railroad purposes. He has a contract for 19,000 bolts for the Hergott Springs R. R., and several contracts from the government.

Bessemer Steel Works in Sweden.—The first Bessemer steel works are to be erected soon. There are not enough railroads to maintain a large Bessemer plant in operation, and the rails have so far been imported from England. The State has guaranteed to take 4,000 tons per annum for four years from the new works, for the State railroads; at $28.52 per ton for the first two years and $27.28 for the last two, which were the prices offered by an English firm.

The International Equipment Co. has been incorporated at Paterson, N. J. by J. V. H. Lawrence, Bronson Peck, Jr., and Bernard J. Burke, New York City; Edward E. Denniston, Philadelphia, and T. M. Moore, Passaic City, N. J. Capital stock, $100,000. The company will contract for the construction, equipment improvement, etc., of street railroads and will engage in the sale and negotiation of railroad stocks and bonds. There will be offices at New York City, Passaic, N. J., and Fort Worth, Tex.

Proposals Open.

(NEW YORK CITY).

Pump, Tank and Connections.—For Primary School No. 8, Mott street. Plans and specifications at the engineer's office, Grand street. School Trustees of Sixth Ward, Board of Education, 146 Grand street. December 13.

Plumbing and Gas-Fitting.—At the new pavilion on Hart's island. Department of Public Charities and Correction, 66 Third avenue. December 15.

Boilers and Steam-Fitting.—At the penitentiary, Blackwell's island. Department of Public Charities and Correction, 66 Third avenue. December 15.

City Work.—Regulating, grading, curbing, guttering, flagging and sewers. Department of Public Works, 31 Chambers street. December 16.

Steam Pipe, Radiators, Fittings, Etc.—Department of Public Charities and Correction, 66 Third avenue, December 17.

Grading.—Removing material and grading school site on 138th and 139th streets. Plans and specifications at the superintendent's office, Grand street. School Trustees of Twenty-third Ward, Board of Education, 146 Grand street. December 20.

(MISCELLANEOUS).

Levee Work.—Government levee work to let, in quantities to suit outfits. Toof, McGowan & Co., Memphis, Tenn.

Railroad.—Proposals will soon be invited for the construction of the section of the Cape Breton R. R. from Grand Narrows to Sydney, 45 miles. A. P. Bradley, secretary, Department of Railroads and Canals, Ottawa, Canada.

Well Boring.—The Natural Gas & Oil Co. of Illinois, will receive proposals for boring five wells in St. Clair county, Ill. Wm. M. White, secretary, 112 W. Fourth street, St Louis, Mo.

Ties.—Burr oak cross-ties, in amounts of 30,000 or upwards. Bids must state number, size, place of delivery, etc. Jos. O. Osgood, Chief Engineer, Toledo, St. Louis & Kansas City R. R., Toledo, O. December 15.

Bridge Repairs.—Repairs to center pier and abutments of Hamilton avenue bridge. Department of City Works, Municipal Building, Brooklyn, N. Y. December 15.

City Work.—Grading and cobblestone paving; setting gas lamps, etc.; and constructing sewer. Separate bids. Department of City Works, Municipal Building, Brooklyn, N. Y. December 17.

Masonry.—For court-house at New Albany, Ind. Office of Supervising Architect, Treasury Department, Washington, D. C. December 21.

Boiler.—For light-house tender "Wistaria." Office of the Light-House Board, Treasury Department, Washington, D. C. December 21.

Brickwork.—For the new depot in Montreal. Plans and specifications at the engineer's office, Point St. Charles. Joseph Hickson, General Manager, Grand Trunk R. R., Montreal, Canada, December 22.

Bridge.—At Hyde's Ferry, Tenn. For grading the approach; stone masonry in piers, abutments and foundations; brick and stone masonry for the same; for each separate span for a combination superstructure; for each separate span for an iron superstructure; for iron trestles instead of span No. 1. Edward Laurent, Secretary of Bridge Committee, Nashville, Tenn. December 22.

Stone.—For breakwater at Rockland, Me. Major Jared A. Smith, U. S. Engineer Office, Portland, Me. December 24.

Heating and Ventilating Apparatus.—For court house at Oxford, Miss. Office of Supervising Architect, Treasury Department, Washington, D. C. December 27.

Masonry.—Stone and brick work for the extension of the court-house at Des Moines, Ia. Office of the Supervising Architect, Treasury Department, Washington, D. C. January 3.

Bridges.—Nine bridges, plans and specifications at county clerk's office, J. W. Niehaus, County Clerk, Leavenworth, Kan., January 5.

Gas Franchise.—Proposals must specify the time for franchise to run, charges for private consumers and for street lighting. Henry Lockhart, chairman, Water and Gas Committee, Socorro, N. M. January 10.

Water Bonds.—$30,000 bonds for the construction of the water-works. Henry Lockhart, (as above), January 17.

City Work.—The following proposals were opened December 8th at the Department of Public Works, New York City: (1) Granite block paving on 87th street, from Madison to Park avenue. J. G. Smith, $3,963.25; J. B. Devlin, $4,019.37; Geo. F. Doak, $3,893.19; Thos. Gearty, $4,194.67; J. Cox & Co., $4,068.40; Chas. Guidet, $4,061.55 WM. KELLY, $3,735.30—(2) Granite block paving on 121st street, from Sixth to Seventh Ave., J. G. SMITH, $6,951.04; J. B. Devlin, $7,132.24; Geo. F. Doak, $7,181.14; John Cox & Co., $7,506.32; Chas. Guidet, $7,875.30; Wm Kelly, $8,077; W. A. Cumming, $8,453.04.—(3 Belgian block paving on 132nd street, from Madison to Fifth avenue, W. A. CUMMING, $2,716.86; Thomas Gearty, $2,945.17; Chas. Guidet, $3,549.58; Geo. F. Doak, $3,341.40; P. H. Fitzgerald, $2,934.65; J. B. Devlin, $3,629.19.

(4) Regulating, grading, curbing and flagging, on 108th street, from Eighth to Manhattan avenue, Thos. E. Crimmins, $9,627.45; John Slattery, $16,927.90; J. J. Farley, $10,964.54; James Slattery, $18,808.92; JOHN COX & CO., $6,155.60; J. B. Devlin, $9,884.68.—(5) on 137th street from Tenth to Convent avenue, Charles Warmken, $3,490.72; JOHN SLATTERY, $2,991.81.—(6) on 137th street from Seventh to Eighth avenue, JOHN J. FARLEY, $4,888.18; John Slattery, $5,992.52; B. Mahon, $6,160.56.—(7) on 142nd street from Seventh to Eighth avenue, Charles Warmken, $10,979.08; JOHN SLATTERY, $9,639.96.

(8) Sewer, on Ninth avenue, from 105th to 106th street, John Slattery, $2,327.50; John Moore, $3,145; J. A. DEVLIN, $1,359.75.—(9) on 140th street, between Seventh and Eighth avenues, James Moore, $3,067.50; J. A. Smith $4,082.80; Pat Sheehey, $2,748; John Slattery, $3,610; John J. Montgomery, $3,204; T. F. Murray, $3,377; J. A. DEVLIN, $2,312.—(10) on 148th street between Seventh and Eighth avenues, Wm. Kelly, $4,410.75; John Slattery, $4,882.50; T. A. Smith, $4,633.65; James Moore, $3,937.50; Pat Sheehey, $3,183; J. A. DEVLIN, $2,690.25.—(11) on 72nd street, between the Hudson river and Eleventh avenue, (withdrawn owing to insufficient advertising).—(12) on Lexington avenue, between 122nd and 123rd streets, J. A. DEVLIN, $2,035.50; John Slattery, $2,635; James Moore, $3,070.

(13) Laying water mains or Sedgwick, Tenth and Sixth avenues, 164th and 165th and 75th streets, F. Thilemann, Jr., $7,533.

(14) Furnishing and delivering cut stone at the reservoir at High Bridge, Charles Guidet, $21,768.

The names of the bidders to whom contracts have been awarded are printed in small capitals.

Bridge and Machinery.—The following proposals have been received for the swing bridge at State street, Chicago, Ill.: For bridge, A. Gottlieb & Co., $24,440; King Iron Bridge & Manufacturing Co., $26,774; Keystone Bridge Co., $30,699.—For machinery, Vulcan Iron Works, $2,942; John Featherstone, $3,600; Excelsior Iron Works, $3,929. Contracts awarded to A. Gottlieb & Co., and Vulcan Iron Works.

The Brady Unbalanced Bids.—The John Brady contract on West 95th street, N. Y., was secured by an unbalanced bid of $8.00 per cubic yard for earth and one-quarter cent per yard for rock. Under the original estimate of quantities he should have received about $16,000; but the City Surveyor returned 14,667 cubic yards of earth at $8.00, and 10,831 yards of rock at one-quarter of a cent, making up a bill of $114,000. The first of these bills were paid, but in 1884 the outcry became so great that the city refused payment on the $52,000 balance. Brady sued and got judgment, but now it is charged that he had by various processes powdered up a large quantity of friable rock and removed it as earth. Judge Van Vorst has now ordered a new trial.

Railroads, Bridges and Canals.

Petroleum-Burning Locomotives.—The Brooklyn Elevated R. R. Co. will fit up an engine to burn petroleum for fuel.

Blast Furnaces.—The *American Manufacturer* says that on November 1st, 312 blast furnaces were in blast, with a weekly capacity of 122,641 tons; and two, with a weekly capacity of 63,199 tons, were out of blast. Of the furnaces in blast 62 are charcoal, 112 anthracite, and 138 bituminous.

Real Estate Craze in California.—Mr. G. F. P. Day writes us from Los Angeles, Cal., that engineers have been busy thereabouts subdividing the suburban country into town lots, the abrupt Sierra Madre mountains only being sufficient to stop the real estate craze. He says he is prepared to see a cable road projected up even the slopes of these mountains, and climate sold in the absence of available land.

Garrison Creek Sewer.—Mr. Kivas Tully, C. E., the expert appointed to report on what should be done to complete this sewer, at Toronto, Canada, has reported that the work is in accordance with the specifications and recommends that a few washed out bricks be replaced and the entire work pointed. This confirms the report made a year ago by the city engineer.

Detroit, Lansing & Northern R. R.—Chief engineer J. J. McVean, Ionia, Mich., has put a party of engineers in the field to run preliminary lines for a branch from Grand Ledge to Grand Rapids, Mich.; the line will be about 50 miles long and will be built in the spring if a good location can be found. J. Kvam is in charge of the transit party and W. F. Biggar in charge of the level party.

Electric Railroad.—An electric railroad is in successful operation at Scranton, Pa. The line is about two miles long and the train consists of two cars, seating 26 persons each; the motor is on the front car and the power is applied by gearing to the fore axle. It is operated on the Van Depoele system, the current being transmitted to the motor by means of wires from a traveler running on a circuit wire strung above the track. It is said to work well.

Section Foremen.—The Brotherhood of Railroad Section Foremen of North America has been organized at Council Bluffs, Ia.; it includes representatives from all parts of the country. Grand Chief, M. McInteer, Mt. Auburn, Ia.; Vice Grand Chief, D. Coughlin, Stanberry, Mo.; Grand Secretary and Treasurer, M. Scanlan, 1,227 South Third street, Council Bluffs, Ia.

Improvement of Cherry Creek.—City Engineer Lowrie, of Denver, Col., has made plans for turning the bed of Cherry creek, and thinks the plan quite feasible and of considerable importance. The cost is liberally estimated at $500,000. The proposed channel will be about six miles long, and will commence at a point about eight miles from Denver, and terminate at Sand creek. The grade will be 27 feet per mile.

England Fortifying the Pacific Coast.—The British and Canadian governments have appropriated money for the protection of the Pacific coast and in view of the possibility of a rupture between England and Russia work will be commenced at once. A large dock has been completed at Esquimault to accommodate British war ships. An officer of the Royal Engineers who was sent out to make surveys and plans for fortifications at Esquimault, has recently returned and states that the appropriations are insufficient for the construction of the necessary works at that place.

A City Without Money.—The Board of Commissioners for Asbury Park, N. J., find that the expenses for the year ending May, 1887, will be about $10,000, to defray which the treasurer has about $50 on hand. The deficiency is in a great measure due to the board's failure to secure a special appropriation that was made by the Legislature for roads and to the fact that James A. Bradley, the founder of the place, has refused to advance any more money.

Map of New York City.—A new map of the city above One Hundred and Twenty-Fifth street, has been published by M. Dripps, 113 Fulton street. The map is colored and shows the names of all streets in the annexed district, the new parks, rapid transit routes, line of the new aqueduct, cable roads, and all places of public interest. The map is of convenient size and neat in appearance.

Red River Navigation.—R. Davenport, the engineer in charge of the government work on the Red river, has lately made an examination of Red lake to see if it could, by means of dams, be made a reservoir to supply Red river with water in dry times like the present season, when navigation has been interrupted. He will also make preliminary surveys from Fargo, Dak., to Fergus Falls, Minn., for similar purposes. He says it is quite feasible to connect lakes Traverse and Big Stone, the former being 7 feet the highest, and the distance between them but five miles. It is hoped Congress will make more liberal appropriations next session for improving the navigation of the Red river. The dredging this season has been mainly in the Grand Forks region. Next year more work will be done in the Fargo section.

New York, Danbury & Boston R. R.—The contract for construction from New York to Danbury has been awarded to Heman Clarke & Co., and work will be commenced before the new year. The road begins at the New York City line on Bronx river and passes through Mount Vernon, Mamaroneck, Rye, Port Chester, where it crosses the N. Y., N. H. & H. R. R., and Ridgefield to Danbury. A syndicate has subscribed for $1,000,000 of the first mortgage bonds.

Report of the Chief of Engineers.—In his annual report to the Secretary of War, Brigadier General Duane, chief of engineers, expresses the belief that the failure of Congress to make appropriations for sea-coast defences has mainly arisen from the difficulty in determining the best method of procuring armor plate. He says the preparation of sites, the construction of masonry foundations, the building of mortar batteries—work equally necessary with that of procuring armor—will demand much time, and it is earnestly recommended that funds be at once appropriated for the emplacement of turrets and casements for rifled batteries, for 12-inch rifled mortars and for submarine mines, all of which can be accomplished before armor plate will be required. The estimates submitted, aggregating $1,043,000, are based upon the present defensive system of our sea coast, the amount estimated as necessary for preservation and repair of fortifications being required to prevent such modern batteries as we now have from going to ruin and to maintain old works, many of which can now be considered as relics of a historic past.

New Bridges.—At Chicago, Ill., there is considerable agitation in favor of the early construction of a swing bridge at Jackson street.—At Cleveland, O. the wooden bridge over the Nickel Plate R. R. tracks is to be replaced by an iron structure on stone abutments; it will be erected next year.—A suspension bridge is to be erected at Minneapolis, Minn.; the City Engineer, Andrew Rinker, has the matter in charge.—Engineer Smith, North Adams, Mass., estimates the cost of the iron bridges on the new road to Adams at $15,000; the abutments and road grading are estimated to cost $8,346.—The Brooklyn and Brighton viaduct at Cleveland, O., will not be opened till the spring; the masonry is finished but the iron works are so crowded with work that they have not yet been able to supply the material for the superstructure.—At the new bridge for the Union Pacific R. R. over the Missouri river at Omaha, Neb., five of the 125-feet spans and one 250-feet span have been put in position, two piers completed, and the other two nearly so; only one more remains to be sunk.—A new bridge is to be erected at York Furnace, Pa.; Col. S. C. Slaymaker, Lancaster, Pa., will have charge of the construction.—At Cincinnati, O., a bridge is proposed over Mill creek at the West End; a committee composed of A. H. Bode, Calvin M. Fenner, and others has been appointed by the West Liberty street Extension Association to obtain plans, specifications and an estimate of cost from Mr. Harper, the engineer of the County Commissioners.—A double-track steel bridge is to be built over the North Branch river near Deering Ill., by the Chicago & Northwestern R. R. Co.—It is proposed to build a bridge across the Presumpscot river at Saccarappa, Me.—The new bridge for the Chicago, Kansas & Nebraska R. R., over the Kaw river at Topeka, Kan., will have five spans and cost $100,000.—A bridge over the river is projected at South Rochester, N. Y.—A bridge is to be erected over the Flint river at Albany, Ga.—The first caisson has been sunk for the Missouri river bridge of the Chicago, Milwaukee & St. Paul R.R. at Randolph, Kan.—The new iron bridge over the river Jackson, at Covington, Va., has been satisfactorily tested by the engineer, Mr. Eggleston.—It is stated that the engineers who have reported on the proposed Arthur Kill bridge of the B. & O. R. R. to Staten island, recommend a single span in place of the proposed design with a channel pier.

A New Telegraph Cable Line.—A company is to be incorporated at the coming session of the Canadian Parliament, for the purpose of laying a cable line from Vancouver island to Australia. Among the heavy stockholders are Sir George Steven, Sir John McDonald, A. Smith, Erastus Wyman and Sanford Fleming. Capital stock $10,000,000. The line will run from Brisbane or some other point in New South Wales via New Zealand to Vancouver city, the terminus of the Canadian Pacific R. R.

The Rio Grande & International Bridge & Tramway Co. capital stock $300,000, has been incorporated at San Antonio, Texas, by J. B. La Costa, of San Antonio; S. A. Oliver, Houston, and Zenas King, Cleveland, O. The object of the company is to build two iron bridges across the Rio Grande river—one at Eagle Pass and one at Laredo.

Buildings.

Residences.—Architect J. H. Carpenter, 156 Washington street, Chicago, has commenced taking figures on a block of four residences for Jacob Kramer, 70x74 feet, two stories and basement, on Robey, between Adams and Jackson streets; cost, $18,000. Brown stone fronts, furnace heat, beveled and plain plate glass, iron crestings and finials, electric bells; mantels and grates.

Plans have been made by architect Henry F. Starbuck, 67 Ashland block, Chicago, for a block of two two-story and basement residences, 50x50 feet, for D. F. Bacon, at South Park avenue, near Thirty-second street, Chicago; cost about $15,000. Exterior, pressed brick, stone, galvanized iron, furnace heat, plate glass hardwood mantels, etc.

Stores and Flats.—Architect Fred Kiltenich, 78 Fifth avenue, Chicago, has planned a block of stores and flats for C. Schenckler, 255 Blue Island avenue, to cost $15,000. Exterior, pressed and common brick, stone trimmings, terra-cotta, galvanized and structural iron and plate glass.

Churches.—The Third English Lutheran Society, of Louisville, Ky., will erect a new church edifice, to cost $16,000; 76x85 feet. Pressed brick, stone, terra-cotta, stained glass, furnace heat, etc. McDonald Bros., Louisville, Ky., architects.

The Episcopal congregation of Zion Church, Freeport, Ill., will erect a new edifice, to cost about $16,000. Materials, pressed brick, stone trimmings, slate roof, furnace heat, stained glass, carpets, upholstery, organ and furniture. Henry F. Starbuck, 67 Ashland block, Chicago, architect.

Plans have been agreed upon for the erection of a new M. E. church, corner Independence avenue and Olive street, Kansas City, Mo., at a cost of about $70,000. The chapel part will be commenced at once, at a cost of $21,000. It will be an adjunct to the Grand avenue M. E. church.

The First Presbyterian Society, Chicago, has decided to dispose of the present property, corner Indiana avenue and Twenty-first street, and locate farther south. About $35,000 will be expended on the new lot and building. Messrs. Marshall Field, G. F. Bissell, A. C. Bartlett, H. M. Sherwood and John Alling, are the trustees. Rev. J. H. Barrows, pastor.

Bank Building.—The First National Bank of Sault Ste. Marie, Mich., will erect a bank building, 71x100 feet; to cost about $20,000. The architect has not been selected yet nor plans prepared. Work will be commenced in the spring.

Hotels.—J. M. Lindsay, of Gainesville, Tex., will erect a three-story hotel, to cost $22,000. It will be of brick and stone with all modern improvements.

Plans have been made by Oscar S. Teale, architect, New York City, for a four-story hotel building, to be erected by a stock company at Paducah, Ky., at a cost of $75,000. It will be 108x162 feet; brick, stone, structural iron, hardwood interior, tile and wood mantels, elevators, both passenger and freight, dumb waiters, electric bells and lights, carpets, furniture, etc., contracts not let.

Factory.—The American Lantern Co., which was incorporated some time ago, under the laws of Indiana, will establish its works at Indianapolis. Mr. E. H. Waldron, of Chicago, is now in that city making the final arrangements to that effect and work will begin at once. They will manufacture lanterns, on their own patents, and similar appliances.

Packing House.—The packing house of Messrs. J. F. Sheely & Co., Omaha, Neb., which was burned on December 4, will be rebuilt.

Warehouse.—The Central Manufacturing Co., Owen F. Aldis, president, 65 Portland block, Chicago, will erect a six-story warehouse at 72 to 86 Market street, 60x192 feet; cost, $80,000. Pressed brick, stone, structural and galvanized iron, elevators and steam power, stone sidewalk, curbing and prismatic lights.

Apartment House.—Architect H. B. Wilson, 909 Insurance Exchange building, Chicago, is taking figures on an apartment house, 96x140 feet, for W. H. Thomas & Son, corner Garfield and Lincoln avenues, Chicago; cost about $30,000. Pressed brick, stone trimmings, structural iron, electric bells, etc.

Pulp Mill.—The Union Pulp Co. will erect a pulp mill, 80x60 feet, two-stories, at Appleton, Wis.; to cost $18,000. It will be of frame, requiring machinery and fixtures.

Tannery.—Messrs. L. A. Pfeiffer & Co's. tannery at Appleton, Wis., which was destroyed by fire on November 12, will be rebuilt at a cost of about $22,000.

Court-House.—Jewell county, Kan., will erect a new court-house at Mankato, the county seat, at a cost of $25,000, the plans of which have been drawn by architects Hadley & Cooper, of Topeka, Kan.